Editorial

THERE will be no television in Australia for the present, even on an experimental basis, according to a recent statement of the Postmaster General.

Mr. Anthony revealed this to be a Cabinet decision, giving as his reason the Government's policy to cut imports by 80 per cent.

This will be a blow to all those who have worked hard to obtain a decision on television, and particularly to those who had hoped for the green light to go ahead on a full plan.

While the decision was no surprise to me, I do not think the Government in any case would have agreed to move on television, apart from the possible erection of an experimental station on a low priority basis. In fact I think the Government may have been relieved to find such a convenient and unanswerable reason for its action—unanswerable, that is, assuming one agrees with the necessity for the severe cut in imports. With this point, I am not concerned at the moment.

My view is the same as it was a few months ago when I expressed the opinion that the Government could not agree to commence television while its general financial policy included the restriction of credits.

It is true that television would have called for quite a bit of importing, involving a large sum of money. But this sum would be infinitesimal compared with the sums involved in the overseas credit problem.

Not so infinitesimal would have been the time payment business without which we can't hope to make and sell large quantities of expensive television sets, loaded down as are all radios with the almost unbearable sales tax.

Personally, I feel that the price question on television receivers has been taken far too lightly. It isn't enough just to remark that television sets will be "a bit dearer" than AM sets or that they'll cost a little more than a good radiogram. Such estimates are often based, quite falsely, on mass-produced English receivers which carry a sterling price and are technically much simpler than a receiver could be for Australian standards. One has only to add up the total number of likely components, estimate the manufacturers' overhead, allow for "free" but very expensive service, add sales tax and trade margins to arrive at a rather apalling total.

No argument in favor of television is strong enough to cancel out the fact that the Government does not consider large sums should be spent on television while it is undergoing so much criticism for doing unpopular financial things about industries much more vital, particularly when these sums would involve such a big addition to the nation's time payments.

Television isn't the only branch of radio and electronics affected by the import reductions. There has been built up an appreciable stream of radio components, valves, pick-ups, loud speakers etc. from England, most of which presumably, will retract to a mere trickle. The situation will be most serious for some firms which have concentrated on English imports. It has caused no little consternation in the record world, and will add to the worries of almost every radio and electrical firm in Australia.

There may be some comfort in the thought that when we do get television, it will almost certainly be the better in every way for the delay. It should be, because I don't think we will see it for a long time to come.

John Moyle

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RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

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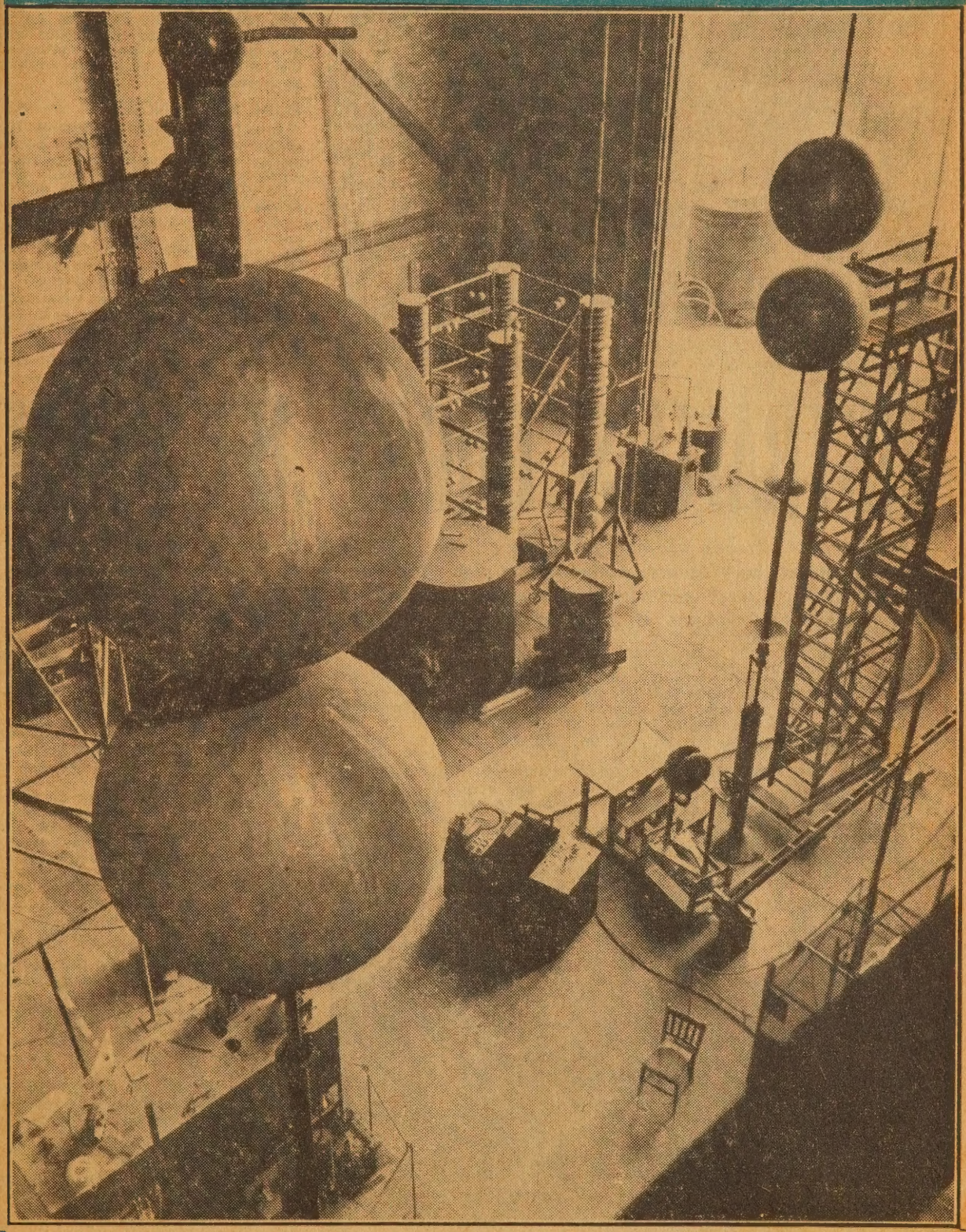
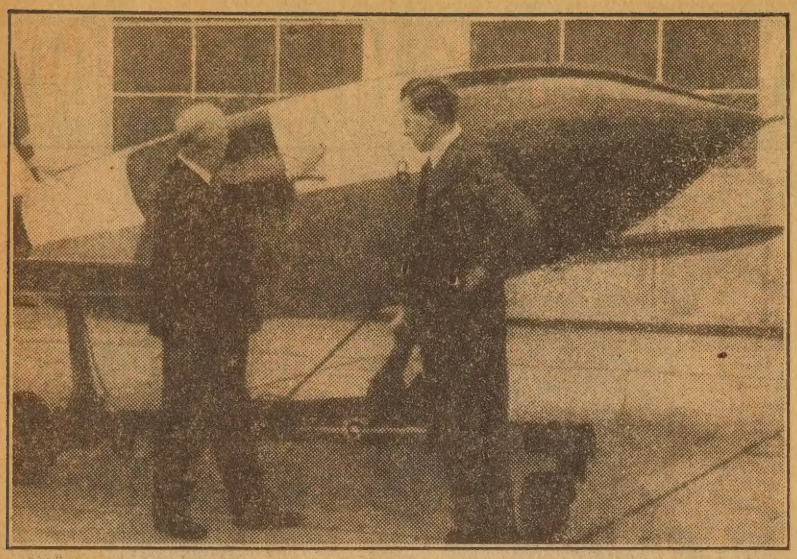
OUR COVER PICTURE

Pity the poor performer as he faces the "business end" of a modern television camera. The impressive — and expensive — battery of lenses is necessary to give a rapid selection of close-up or more remote views with maximum definition at all times.

LABORATORY OUTDOES HOLLYWOOD



More fantastic, more spectacular than any Hollywood set is this view of the high voltage research hall of the National Physics Laboratory in England. Here, voltages up to two million can be produced for testing high tension insulators and switch gear.



Front view of the "Jindivik" showing the sharply streamlined fuselage. Wings are detachable, with constant cord and thickness.

AUSTRALIA'S ROBOT JET PLANE

Evidence of Australia's growing significance in the pattern of Western defence is the rapid development of the Woomera rocket range, plans for atom-bomb tests and research into radio-controlled aircraft and missiles. Filmed by Cinesound cameramen, under strict security supervision, these pictures afford a glimpse of Australia's newest radio controlled jet.

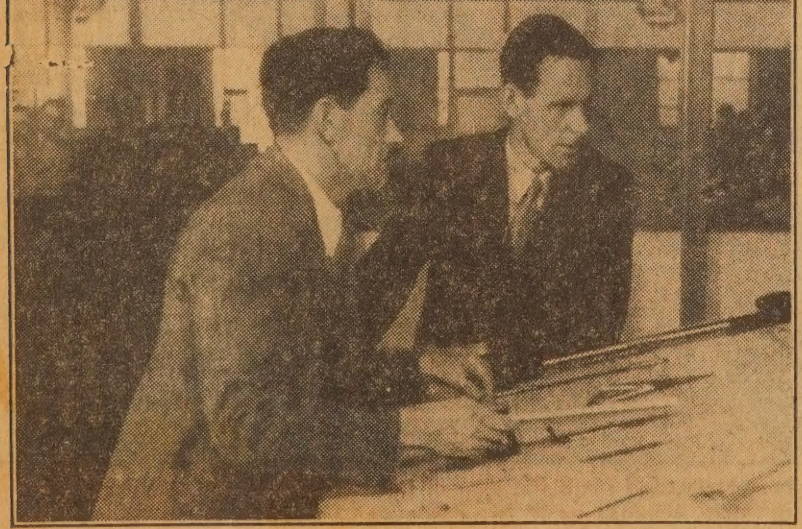
KNOWN as "Jindivik," an aboriginal name, the plane has been referred to as a radio-controlled "prototype fighter." It is relatively small—its overall length is 22ft and wingspan about 20ft — but its jet motor should be a guarantee of a rapid rate of climb and a high top speed.

Estimates put the speed at about 750 mph but actual performance details are a closely-guarded secret.

The motor is reported to be an Armstrong Siddeley "Viper" jet, produced by the same team which gave Britain the "Sapphire," the world's most powerful jet engine.

The "Viper" has been specially designed for use in expendable aircraft and uses low cost components.

It has an annular combustion chamber and an axial flow compressor. Overall diameter is just over 20in, weight 400lb and thrust 1500lb.



The plane was designed in the government aircraft factories in Melbourne. Facing the camera is Ian Fleming, Australian designer of the "Jindivik."

Two such planes have been built and successfully test flown and plans are well advanced for a new and improved version.

As it is, "Jindivik" can be controlled successfully from either a ground station or another plane. Reports indicate that targets have been pin-pointed on the range at up to 300 miles with guided missiles and it is likely that the control system of the jet plane will be at least equally as versatile.

DUAL FREQUENCIES

Scientists seeking to extend the range beyond this figure will be up against the familiar vagaries of radio wave propagation in daylight and over varying terrain. While details of the radio equipment are not disclosed, it seems likely that alternative control carrier frequencies may be required to ensure freedom from "no-signal" zones, which can be expected with any one selected frequency.

The military conception of a radio controlled combat plane is by no means new but its realisation in practice is only now becoming feasible by reason of the rapid advances being made in radio communication and control methods.

At the outset, the main idea behind remote control was to render the plane "expendable," so that it could be sent on missions which could not reasonably be undertaken with a crew on board. Now a new factor is rapidly arising.

Each forward step in the performance of combat planes imposes greater demands on the pilot and crew and the situation may readily arise where these demands will outstrip human faculties. When this happens, design will either have largely to come to a standstill, or resort made to remote control.

MANY USES

In some cases, the control can be semi-automatic as in missiles which use radar to track their quarry automatically. The missiles are launched by remote control, guided to the general vicinity of the target aircraft and then turned over to automatic control.

For reconnaissance work, complete control of the plane must be retained so that it can send back television images of enemy movements and return, as well, with actual photographic records.

Radio controlled interceptors, capable of engaging in "dogfights" are a step further away, necessitating not only a very complete system of radio control but a method by which the enemy's movements and positions can be observed by the remotely placed "pilot."

The possibilities of a push-button air force, where operations can be

planned without a personnel risk, are obvious but it can only be realised with the cloest co-operation between experts in the electronic and aviation engineering fields. That is why "Jindivik" is such a significant item in the overall plan of British Commonwealth defence.

And what is more important, the lessons learned with "Jindivik" and current electronic euipment, will point the way to controlling the pure missiles which may later be required to deliver the atom and hydrogen bombs.

England was early in the "remote control" field, with robot target planes of the simple biplane type. These were demonstrated and used in the 1930's, the "pilot," however, normally keeping the aircraft in sight from the ground.

AUSTRALIA'S EFFORT

Much research went on during the war but, apart from initial control of rockets, automatic proxity fuses and such similar developments, the remote control technique did not find much combat application.

Now it has become a matter of urgency and Britain, faced with the task of developing atomic bomb production, has largely turned over the guided-missile and radio control angle to Australia. An increasing proportion of the research and production is being borne by Australian scientists and factories.

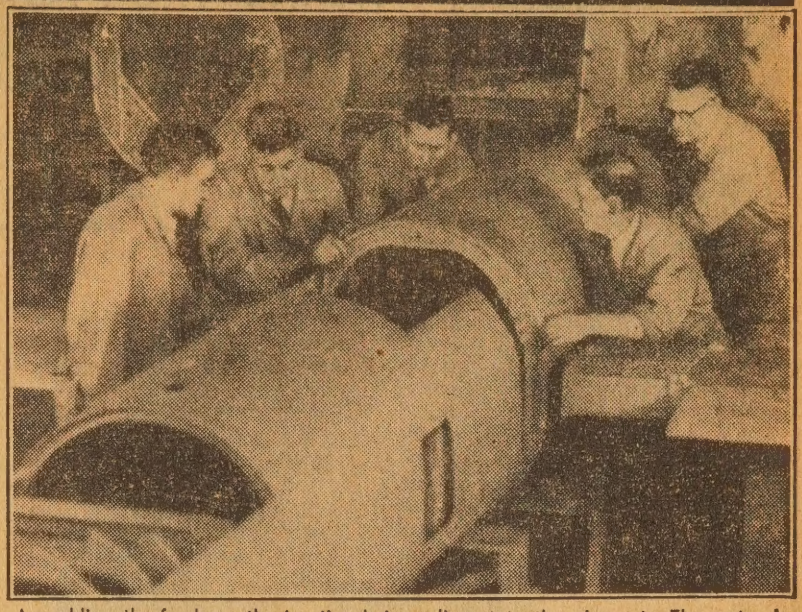
Big names in the Australian team are Mr. W. A. S. Butement, chief scientist ,Professor H. J. Brown and Dr. B. G. Gates. Professor Brown is controller of the Research and Development Branch of the Department of Supply.

Backed by a grant of £50-million, subscribed conjointly by the British and Australian Governments, the Woomera range offers some 1200 miles of sparsely populated territory over which missiles can be flown with ample safety and secrecy.

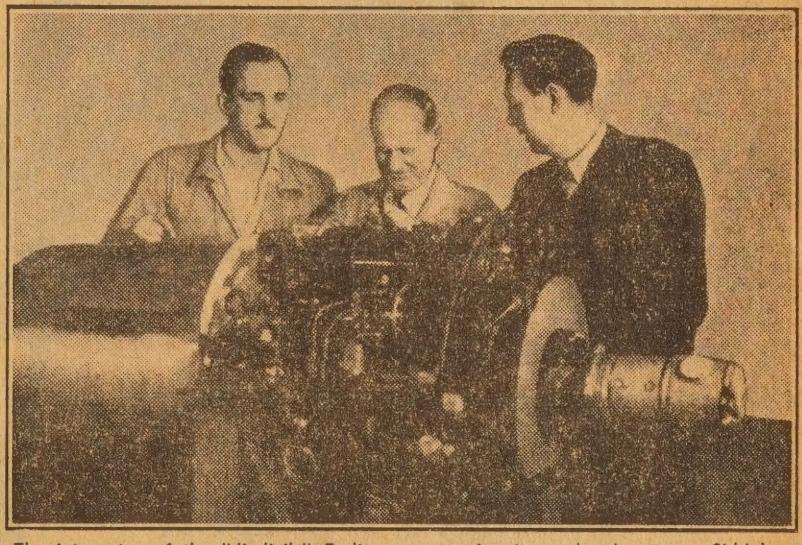
Rival range to Woomera, at least among the Western Powers, is the Cape Canaveral range in the US. Created in 1949, the firing site of the Canaveral range is on the Banana River in Florida. The firing line runs across Grand Bahama, Great Abaco, Eleuthera and Cat Islands. It bypasses San Salvador and then runs out over the Atlantic ocean.

Chief difficulty with the American course is that of recovering rockets and missiles from the sea.

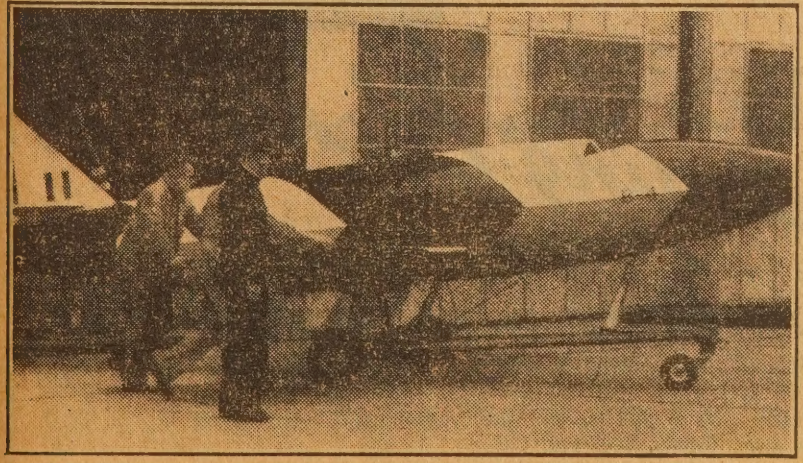
ASSEMBLING THE FUSELAGE



Assembling the fuselage, the junction being adjacent to the wingroots. The motor is housed in this section.



The jet motor of the "Jindivik." Earlier reports give it as the Armstrong Siddeley "Viper," with a weight of 400 and a thrust of 1500 pounds.



A full side view of the plane reveals the slender fuselage and disposable landing gear. Air intake appears to be on top of the fuselage.

Meanwhile great secrecy surrounds American progress in the guided missile field. It is known that the Americans have developed the "Matador" guided bomber allegedly to carry their smaller atomic weapons, and somewhat larger than "Jindiviks." Details of the "Matador" are secret but it is said to be about 30ft long and capable of a speed of 1000 mph. Employing rocket-assisted takeoff, it flies with a single jet and carries only enough fuel for limited range. It is "expendable" being intended to explode along with its atomic cargo.

For long-range missions, the "Matador" would be carried to the general vicinity of the target by a large manned aircraft, then directed to the actual attack by radio.

A US bomber squadron was reported some time ago to be training with "Matadors."

"Jindivik" will show the way to an equivalent weapon.

YOU WANT TO BE A SERVICEMAN?

Television servicemen must be technicians, diplomats, peace-makers, benefactors and a few other things rolled in, according to the RCA Company. Their experiences overshadow anything that ever happened to servicemen in the days before a picture tube joined the loudspeaker.

AN RCA serviceman rapped smartly on the door of the Smith home in Forest Hills. It was the first call of the week and he felt unusually chipper. "Oh, I'm so glad you're here," cried Mrs. S., "you can watch the children while I go to the store." Before the amazed technician could protest, mother had disappeared, leaving him with three screaming little "darlings," aged 4 years, 2 years, and 8 months. The week was off to bad start, but RCA's TV "sur-

geon" heroically inspected the chassis, located the trouble and corrected it, while his temporary wards hid his tools, rode on his back and tried to hide in the empty cabinet. Mother finally returned one hour later and released the baby-sitter for his next assignment.

Hundreds of similar situations confront the easy-going technicians in RCA Service Company branches all over the country. They regard such breaks in routine as "all in a day's work"—24 hours in which the customer is always right.

The RCA experts, skilled at curing TV's mechanical ailments, must be equally adept as public relations men. When a Norwalk, Conn., woman phoned the service branch, demanding: "Where do I send the bill? While backing my car out of our drive into the street, I smashed into one of your trucks and put a gouge in my fender!", the manager calmly advised: "Just be brave, madam, and tell your husband."

PIED PIPER

One customer, detecting strange burning odors in his receiver, gazed in astonishment as RCA's "exterminators" removed several electrocuted mice from his highly-polished cabinet. "They must have come inside the set from the factory; *we* don't have mice!" was the reply.

One service manager succeeded in reuniting a Rockaway, NY, couple whom television had estranged. The day after their set was installed it needed adjustment, at which point Mr. X. upbraided his spouse for spending all that money for nothing. Blows were exchanged, neighbors called in police, and wife went home to mother as the first step in divorce proceedings. With the best of intentions, the RCA manager talked to both parties and arranged to have a new receiver delivered two days later. The manager was duly cnagrined when Mr. X. stormed into his office with these words: "I've been trying to get rid of that old battleaxe for 10 years, and now when I have a perfect excuse you have to go and ruin it!"

Although medieval armor is not in vogue these days, many a bruised TV mechanic would welcome its protection. Such was the case of the eager young technician who, having erected a difficult rooftop antenna, stepped back to admire his work. When he landed on the hard ground, the mistress of the house asked if he had knocked any slate from the roof. "Lady, I came down too fast to count them!" was his bewildered reply.

A similar incident occurred on Long Island during the blizzard of 1947. While mounting an antenna, the serviceman slipped off the icy rooftop, landed in a snowdrift and, somewhat dishevelled, rang the doorbell. After reviving the astonished housewife, who fainted at the sight of him, the technician completed the installation.

If a home-owner wants to know how solidly his house is constructed,

serviceman Clark can tell him. He tests all ceilings and beams these days, before starting work. While rigging an antenna in the unfinished attic of a Bronz dwelling, Clark lost his footing, slipped between two beams, crashed through the ceiling, and landed on a card table surrounded by a ladies' bridge club.

The Service Company's unusual case histories are not without their share of international flavor. A penniless Oriental prince, posing as a bona fide UN delegate, stormed into headquarters demanding immediate and very special TV service. Investigation revealed that he lived over a cheap 52nd Street nightclub, but through some scheme received his mail and phone calls at Lake Success.

Two RCA technicians have the distinction of being invited into a Russian inner sanctum. The dubious duo set out for the Russian Embassy, housed on the Morgan Estate at Glen Cove, Long Island. They were "welcomed" at the gate by heavily-armed uniformed guards who escorted them to the mansion. Inside two other guards, this time with mere revolvers, scrutinised the entire procedure. When the technicians ra the TV feed line down from th attic, their Soviet "helpers" tried t stop them on the grounds that th would make the pictures come i upside down. After completing th installation, our heroes were up braided because the receiver "woul not tune in Russia, where televisio was invented."

In direct contrast was the tem porary TV installation made for th President of a South American re public during his New York visi In an effort to cement Latin-Ameri can relations, RCA's technician trie to give immediate service, but wa asked to come back at 5 pm, as th President was taking his siesta When he returned at the appointe hour, the serviceman had to wai in the hotel lobby until the dignitary properly garbed in his dinner clothes could receive him.

NOT AT HOME

A simple address on the day' schedule often turns out to be virtual obstacle for the dauntles serviceman. One call—a confection ery store in a Garfield, NJ—was i reality a "horse parlor." The RC technician rang the bell and knocke loudly, but received no answer. A bystander gave him a second addres which proved to be a Social Club Here he was referred to a thir address where he finally found man with a key to the confectioner store in which the TV set wa located.

Whether they have to climb a stee slope to a hillbilly's shack, or rov out to a house built on stilts, servic crews generally accomplish thei missions. Unless, as happened i Paterson, NJ, the technicians try t instal a TV receiver in a Turkish Bath on "Ladies' Day."

On occasion the impossible rear its defiant head to stump the mos experienced serviceman. Witness th time one tried to locate the sourc of heavy interference on a Bronz

set located in a good reception area The enterprising RCA man finall gained entrance to an unfinishe attic which had been closed off fo over 10 years. Here he found lighte an old, chattering carbon bulb, ap parently installed by the worker who had run the original electri

(Continued on Page 112)

If you hold a **1st or 2nd Class Radio Ticket**

YOU NOW HAVE AN OPPORTUNITY TO JOIN

A band of 100 Radio Officers

Posted as far apart as Perth and Port Moresby, these Radio Officers are nevertheless a closely-knit team doing a vital job. Amongst their ranks there are opportunities now for more qualified radio men.

SALARY RANGE:
£650-£792 subject to cost of living variations, plus extra pay for duty performed on holidays, week-ends and shift work.

DISTRICT ALLOWANCES:
These are additional to salary and are paid at Northern Stations.

HOURS OF DUTY:
36 per week.

RECREATION LEAVE:
Three weeks per year. Four weeks at Northern Stations with travel concessions.

GENEROUS SICK LEAVE.

SUPERANNUATION ON RETIREMENT AND LONG-SERVICE LEAVE.

Responsible Postings that Offer Grand Comradeship

Coastal Radio Stations are situated in all capital cities and at various places around the coast of Australia and in Papua and New Guinea. Grand comradeship exists between the band of Coastal Radio Officers and their wide range of contacts on ship and shore. Applications are invited now from Radio Officers holding 1st or 2nd class tickets to join "Coastal Radio."

District Allowances and Extra Pay for Shift Work, Holidays, Week-end Duty

Initial appointments will be to Sydney Radio, but officers may later be required to serve at northern stations. District allowances at non-metropolitan stations vary between £15 and £175 per annum and are additional to salary. Penalty rates are paid for shift work, week-end and holiday duty. There are staff cottages at Papua-New Guinea stations and non-metropolitan stations in Australia.

For further information call, write or phone.

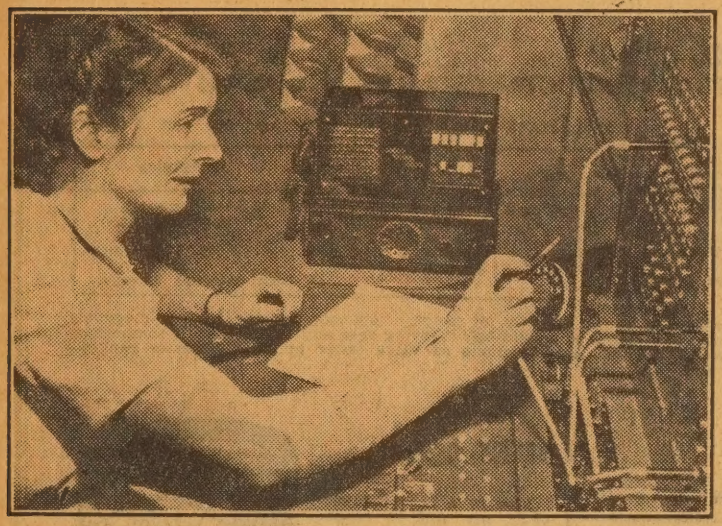
OTC

THE OVERSEAS TELECOMMUNICATIONS COMMISSION (AUSTRALIA)

Chief Administrative Officer
47 YORK STREET, SYDNEY. B 0544—EXTENSION 317

OTC7.FP.81

RECENT DEVELOPMENTS IN FRANCE



In a review of recent developments, Mr. Javillier, retiring President of the French Academy of Sciences. stressed that 1951 had been a productive year both in fields of research and on the industrial front.

MR. JAVILLIER revealed that the National Centre of Scientific Research has built a new atomic pile at Saclay, on the outskirts of Paris, and also put into service two new wind tunnels for aerodynamic research. The tunnel at Vernon is capable of producing velocities up to four times the speed of sound.

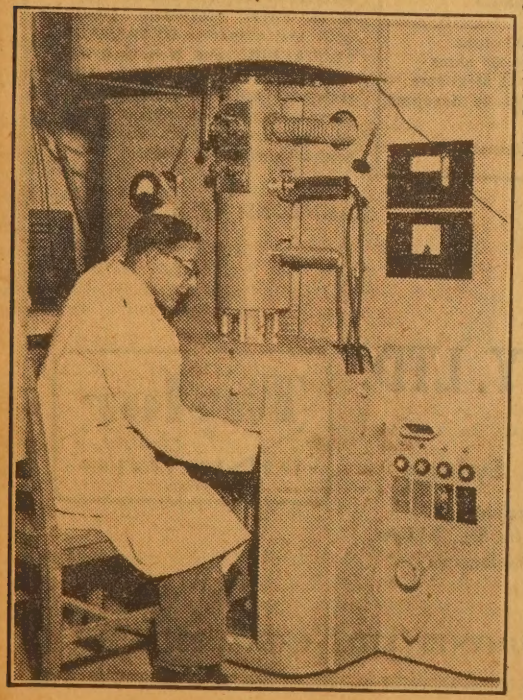
Astronomers the world over have benefited greatly from the coronograph, developed by M. Bernard Lyot, which allows observation of the solar corona in broad daylight. Measurements have been made, by other means of the atmospheric conditions on Mars, and original and enlightening research carried out also into the nature of Beta rays.

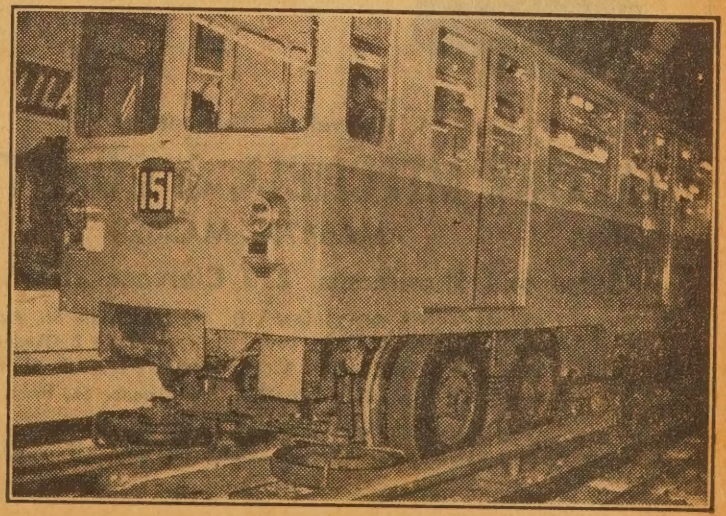
On the industrial front, many new devices have been put into service. What is claimed to be the first amplified telephone system is now operating, using loudspeakers and remote microphones in place of the familiar earphones.

Complicated wiring has been eliminated altogether from the traffic lights shown at the top right. Their operation is controlled and synchronised with other lights by radio, received via the antenna atop the light structure.

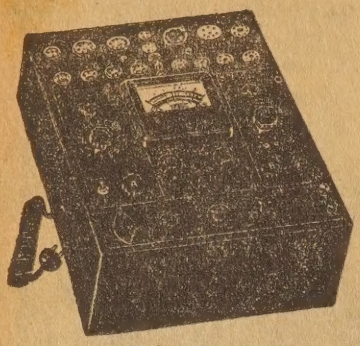
The now-familiar electron microscope has been modified to photograph minute objects by the use of protons. Using electrostatic deflection, the new "Protonic" microscope is said to have magnification of 500,000 times and will enable the study of microbes which have thus far not been examined.

Smoother, more silent rides will be enjoyed by French underground passengers, if a new type of rail car goes into general service. It rides on 4-wheel bogies fitted with pneumatic tyres. The bogies are steered by the two horizontal wheels seen at the front, while an auxiliary flange metal wheel is retained as a precaution against puncture troubles.





SOLVE YOUR PROBLEMS WITH **TAYLOR** TEST EQUIPMENT



MODEL 47A-P

MUTUAL CONDUCTANCE VALVE AND MULTITESTER

Fitted with large direct reading meter with illuminated dial and OVERLOAD PROTECTION. Tests over 2000 American English and Continental valves including latest types. Filament volts range from 1.1 volts to 117 volts. Filament continuity and element shorts shown directly on meter. Cathode leakage read in megohms. The instrument is housed in a solid oak carrying case and supplied with comprehensive instruction manual. Also available as valve tester minus multitester ranges—Model 45 A-S.

MULTITESTER RANGES. 1000 ohms per volt A.C.-D.C.

D.C. Volts	D.C. Current	A.C. Volts	Resistance
0-120 m.V.	0-0.6 mA	0-3	0.5-22.5-1000 ohms.
0-3	0-6 mA	0-15	50-2250-100,000 ohms.
0-15	0-30 mA	0-150	x 500-22,500-1 megohm.
0-150	0-150 mA	0-300	x 5000-225,000-10 Megohms.
0-300	0-1.5 Amps	0-600	
0-600			x with external battery.

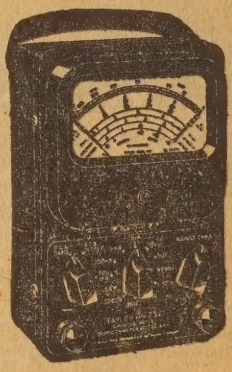
IMMEDIATE DELIVERY

MODEL 75A

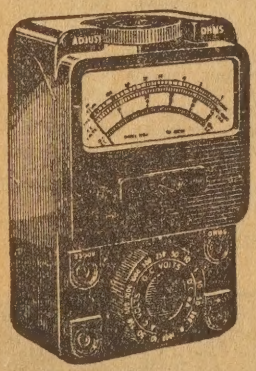
RANGES 20,000 ohms per volt A.C.—D.C.

D.C. Volts	A.C. Volts	A.C.-D.C. Current	Decibels	Resistance
0—0.1	0—1	0—50 uA	—30 to —5	1—50—10,000 ohms
0—2.5	0—2.5	0—5 mA	—22 to +3	1000—50,000—10 Megohms
0—10	0—10	0—50 mA	—10 to +15	*10,000—500,000—100 Megohms
0—50	0—50	0—500 mA	+4 to +29	
0—250	0—250	0—5 Amps	+18 to +43	*With external battery.
0—1000	0—1000		+30 to +55	

This is a robust 20,000 ohms per volt 50 range universal multimeter designed for accuracy and stability. Fitted into an attractive case, the meter is provided with instantaneous OVERLOAD PROTECTION. The clear, easy to read scale has a length of 4 inches. An internal buzzer is provided for quick continuity tests. Complete with test leads.



MODEL 120A POCKET MULTIMETER



RANGES 1000 ohms per volt A.C.—D.C.

D.C. Volts	D.C. mA	A.C. Volts	Resistance
0—0.25	0—1	0—10	0.5—20—2000 ohms
0—10	0—10	0—50	50—2000—200,000 ohms
0—50	0—50	0—250	*500—20,000—2 Megohms
0—250	0—500	0—500	*5000—200,000—20 Megohms
0—500		0—1000	
0—1000		0—2500	*With external battery.
0—2500			

This is an accurate pocket size instrument using a robust, sensitive meter movement fitted with instantaneous OVERLOAD PROTECTION and is housed in a high grade moulded case. All resistors used for voltage and current ranges are adjusted to an accuracy of 1%. Supplied complete with test leads.

DIMENSIONS: 4¾" x 3¼" x 2"

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Taylor Best for TEST EQUIPMENT

Manufactured by:—TAYLOR ELECTRICAL INSTRUMENTS LTD., GREAT BRITAIN

STANDARDISE AND SAVE MONEY

During the war the difference between the British and American standards screw threads is estimated to have cost the two nations £25 millions. If both countries had had the same standards there would have been immense sa vings all along the production line. I give this striking figure, quoted in an official document, to show what can be achieved by standardisation when you really try.

STANDARDISATION is a word that has acquired an unpleasant association, smacking of everyone being forced to buy the same kind of soap, live in the same kind of house, eat the same kind of bread, and generally, be allowed no freedom of choice in the everyday things of life. Standardisation, in the technical sense, has really nothing to do with this. It means reducing the variety of patterns of things which have one and the same purpose, and concentrating manufacture on the standardised sizes.

NOTHING FITS!

The convenience of this method is obvious to anyone who has wanted a spare nut and bolt, or even a pound of nails; the choice of nails in every imaginable size from half an inch to three inches would not only be bewildering, but extremely wasteful in manufacture, since a different machine setting would be required to produce each size.

This is what the engineer calls "dimensional standardisation." Standardisation may also be "functional," that is to say, agreement about certain standards of performance or quality may be decided.

Standardisation may be on composition, as it is with food and drugs, so that the consumer knows what he is getting; or it may be a matter of performance, as with a steel girder, where the engineer will be certain that it will bear certain stresses.

The two kinds of standardisation may also be combined again as in a girder, where both sizes and performances may be standardised.

Steel and iron sections are a good example to take, because they were among the first things to be standardised in Britain. Fifty years ago, perhaps as many as a thousand different sections were being produced. After consultation, it was found possible to reduce the number to 175 standard specifications to cover every possible need.

TRAM RAILS

There were 75 different kinds of tram rails. Standardisation enables them to be reduced to five.

Not so long ago investigation showed that no less than 3000 different types and sizes of colliery tub wheels were being used in British mines. British standards for 25 were found to cover every possible purpose.

And so it has been with one industry after another, when the possibilities of standardisation have been investigated.

Not so long ago, the most infinite variety of gear wheels in clockwork meant the production of an equal variety of cutters. One manufacturer alone was asked to make 800 different types of the same part. Standardisation enables the numbers — covering the same needs — to be reduced to 11.

After the last war, the United States conducted an investigation into the saving that could be achieved by standardisation. They found that there were 98 different sizes of roofing slates, and, after discussion by all parties interested, it was agreed that 48 would serve.

There were 67 varieties of hospital beds manufactured — and it was decided that four would cover the same needs. There were 11 different brick sizes, and this was cut to five. In general, it was found that the "avoidable waste" due to lack of standardisation, mostly unnecessary multiplicity of sizes, varied between 30 and 60 pc.

AROUND THE HOME

We have been doing something of the same kind in Britain since the stress of war. It is probably a surprise to most people to learn that before the war we had 680 different kinds of windows and several hundred different kinds of baths. The production of this diversity meant waste.

In other cases, unnecessary variations means inconvenience. There are, I believe, about 800 different types of radio valves, with an almost infinite variety of fittings.

People who have had to get their sets altered to take some valve with the same performance but a different fitting, will appreciate the benefits that come if the radio industry were able still further to reduce the number of types.

by Professor A. M. Low

Today, we take some forms of standardisation for granted. The "battle of gauges" on the railways seems fantastic until we remember the variety of voltages of our electric supplies today, slowly being standardised at immense cost, when a little forethought would have shown the enormous advantages of having the same voltage all over the country.

The benefits of standardisation accrue to manufacturer, distributor and consumer. In a nutshell, the manufacturer producing less variety saves by having fewer machines, requiring less factory space, needing smaller technical and inspection staff and in carrying smaller stocks of raw materials.

The distributor saves by requiring less capital locked up in stock and less storage space—imagine the storage and stock problems of a radio dealer who was determined to be able to supply any customer with any part for which he asked!

The consumer benefits by reduced prices and convenience in being able to get replacements.

In the case of one shoe manufacturer who determined to do a little standardisation of his own, he found that by reducing his output from 2500 different sizes and styles to the 100 most popular, he could save 25 pc on overheads, 30 pc on the cost of production, and 27 pc in the cost to the consumer.

Incidentally, his turnover went up by 50 pc, and if he lost a few customers who required virtually a "hand-made" article, he gained many others by the reduction in price.

The British Standards Institution, which grew out of a committee which met to standardise steel sections in the 90's, has done, and continues to do, a tremendous amount of work. The number of new standards agreed averaged about 90 a year before the war, and the total number of British Standards now exceeds 1325.

VOLUNTARY BASIS

I have used the word "agreed" deliberately. The standards are not—except in certain cases, like food and drugs—enforced. The basis of organisation is committees representing particular industries—there are about 38—while the producer, user and distributor are represented.

Each committee considers the desirable standards in its own industry, and where other industries are affected, the standards are prepared by joint committees. The institution received government aid for its national work, but is not government controlled.

This is one of the secrets of its success. Standardisation in accord with the needs of industry, fulfilling a generally recognised want, taking into consideration the interest of producer and consumer, maintained by industry as a whole, and quite independent, is a very different thing from standardisation by the State.

It is important, I think, that we should have a minimum of standardisation in the things through which we express our personality. The consumer should be given the widest possible choice of really different articles—and it is important that the decision on what he might want should be made by the manufacturers, chambers of commerce and

(Continued on Page 17)

The range of
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- Signal generators
- Super testers
- Super tracers
- Multimeters
- Current transformers
- Sequential exploders
- Blasting Circuit testers
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- Meters of all types

FINE TEST GEAR

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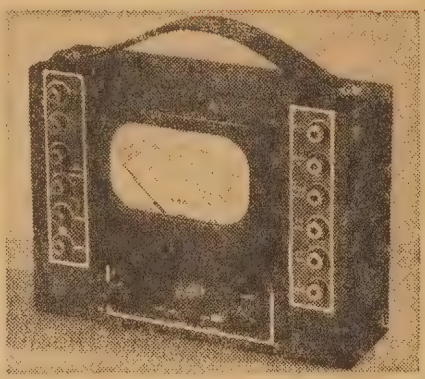
in *kit form* these instruments cost only a *fraction* of the assembled price.

MODEL MK1 MULTIMETER KIT



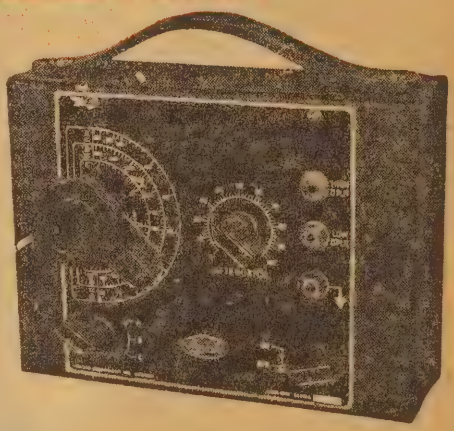
This A.C./D.C. Multimeter Kit comes to you complete with everything right down to the last nut and bolt. It is carefully engineered and designed and all Resistors, Shunts, Meters, etc., are carefully pre-calibrated in the Factory to an accuracy of 1 per cent. Thus when you complete building this instrument there is no further calibration necessary. It has a wide range of A.C. and D.C. voltages up to 1000 volts and current can be measured in the following ranges:—

1, 10, 50 and 250 Milliamperes.

It is entirely self-contained for resistance readings which are up to 100,000 ohms.

It uses the popular 4" square type Meter with a clear Multi-Scale. All wiring instructions and constructional details are given with the Kit, and photographs and circuit diagrams make it simple. A completely illustrated well written Booklet of Instructions accompanies every Kit, and your guarantee of satisfaction is in the name "University." The size is 6" x 8" x 2½", and it's an exact physical replica in size to the Model OK1 Oscillator Kit, which is its companion.

MODEL OK1 OSCILLATOR KIT



For years of active service, yet simple to build at home with a few ordinary tools, Model OK1 Oscillator Kit covers all fundamental frequencies in the average receiver. It comes to you complete right down to the last nut and bolt and assembly can be done at home with a few simple tools. The Dial, Condenser, and Coil set-up is specially pre-calibrated at the Factory so that no further calibration is necessary when you complete building this instrument.

Standard Batteries are used and each OK1 Kit is complete with an Instruction Book which gives pictures and wiring diagrams of all parts and in addition gives full operating instructions for using the Oscillator to the best advantage when you have finished it.

It is carefully packed and all Metal Parts are pre-calibrated so that no heavy work has to be done. Pleasing in appearance yet effective and simple in its use, it makes an ideal Portable Battery Oscillator for the Serviceman or Home Builder.

RADIO & ELECTRONIC TEST EQUIPMENT

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MACHINE TORTURES PLANE PARTS

A scientific torture machine with a 500,000-pound squeeze, used to test the strength of airplane parts, was unveiled recently by the Lockheed research engineers. The new device was described as the most powerful aircraft tester of its type in the world.

CALLED a "fatigue tester," the stretcher-compressor is the largest and most bruising device of its kind ever developed in the aircraft industry, according to H. W. Foster, dynamics research engineer, who designed the apparatus and supervised its construction at Lockheed.

The new unit can pound its pressures as fast as 2000 times a minute, or as slow as 5 times a minute.

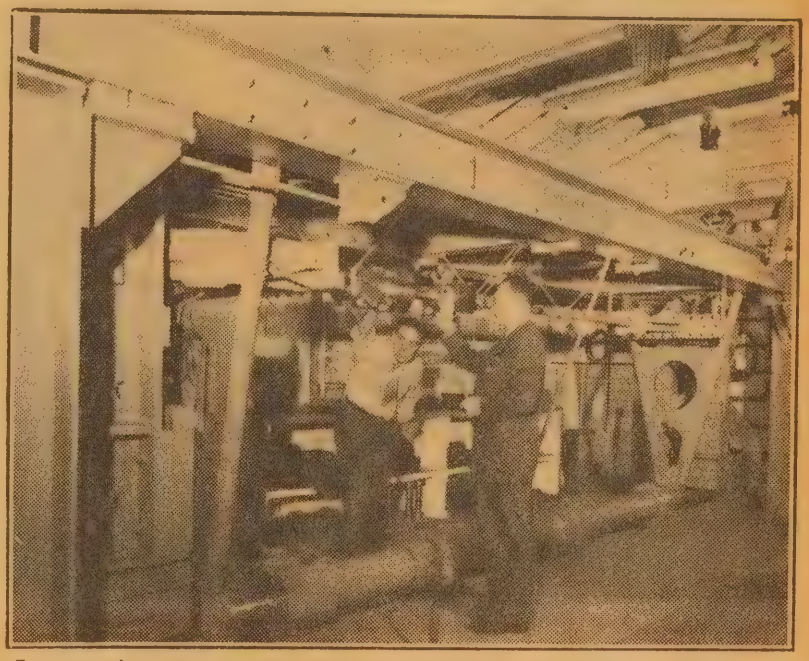
Typical of high-strength parts which the new machine alone can handle are the damper piston of a Super Constellation landing gear and sections of the transport's wing structures. The piston, for example, is made of high-heat-treat steel capable of withstanding greater loads than any steels previously made.

DIMENSIONS

The machine measures 20ft long, 7ft high and 6ft wide. It handles parts up to 12ft long and 5ft wide. In principle, it differs little from other Lockheed-developed inertia-loaded fatigue-testing machines of smaller capacity, except that it employs a moving instead of static reaction in order to avoid driving its full force into its foundation.

Principal parts of the machine are a steel-girder framework, from which the pressure-applying apparatus is suspended; two heavy beam assemblies suspended by flexible mountings from both ends of the overhanging frame; an electric-powered rotating, unbalanced weight in one beam assembly; a horizontal hydraulic jack inter-connecting the beam assemblies at their lower ends.

The specimen, or part to be tested, is clamped between the beams — the jaws that apply the bite. Connection rods, varying in length with size of the part, hold the specimen in place.



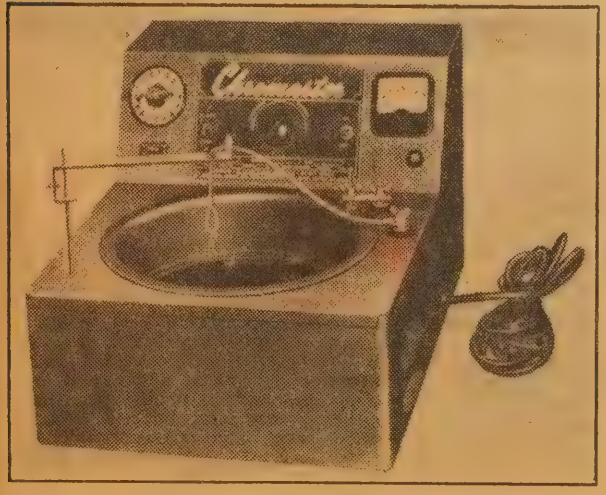
Two research engineers prepare to test a landing gear piston. Stresses are produced by the hydraulic jack seen just above the floor and a rotating unbalanced weight in the cabinet on the left. Components can often be made lighter and stronger at the same time by such specialised study.

First a fixed preliminary force is applied to the part by a hydraulic jack, or preloader, which squeezes the two beam assemblies against the specimen. The jack alone can produce up to 250,000 pounds of pressure.

Next, the weight is started rotating. It sets up a violent vibration, amassing an additional applied force equal to the hydraulic jack's force. Mechanics of the machine cause the total torture to alternate rapidly in opposite directions, compressing and stretching. The hydraulic pressure can be steadily increased. Strain gauges affixed to the part keep a record of exact force applied.

Lockheed has six 10,000-pound and one 50,000-pound fatigue machines, in addition to the new unit. All were designed and built by Lockheed personnel.

CHROME PLATING MADE EASIER



This self-contained chrome plating bath will deposit .0001" of chrome in 3½ minutes. Known as the "Chromaster," it uses a special "Chromasol" plating solution, which eliminates the need for metallic "undercoats," or pre-heating, and additional electrodes. Odd shapes and inside surfaces can be readily plated. (Manufactured in the U.S. by Ward Leonard Electric Co.)

NEW PHOTOCOPYING DEVICE

AN innovation in photocopying is made possible by the development of a new machine called "Auto-Stat," by the American Photocopy Equipment Co.

Operating on a rapid, automatic developing process, the device can quickly reproduce clear, black and white dry photocopies of any type of paper work produced in an office. No special skill is required to operate the machine, the makers claim, and it requires no chemical trays, running water, &c. Finished copy is produced from the original within half a minute.

Requiring no more space than that needed by a typewriter, the new device can be operated on a section of a desk top. In normal office use an operator can produce 100 copies per hour.

With a brood like that, this humming bird has something to sing about. Its vocal range is said to be extremely wide, extending from quite a low note to a pitch beyond human hearing.

WHEN IS SOUND NOT SOUND?

The science of acoustics has gained great impetus since the advent of the electronic valve and, today, sound is one of the great aids to modern living. Where would we be today without our "canned" music, our talkies and public address systems?

OF course many of us could doubt whether sound is much of an aid, but this arises more from the abuse of sound than from anything else.

Violent surges of sound from a neighboring loud speaker, carried far into the night, is not conducive to right thinking about this matter.

Of no assistance either is the loud honking of motor horns, the intolerable clang of trains in underground railways, steel rivetters and compressed air machines on roads, nagging women and the "start work" whistle.

WELCOME SOUNDS

Among the most pleasing sounds are the uttered words "come and get it" or "it's on," "here comes the pal clerk" and, of course, the "knock off" whistle is alawys welcome.

It's all a matter of relativity whether one looks upon a sound as being objectionable or otherwise.

To a worker engrossed in a problem, which is dear to his heart, even the "knock off" whistle can be an unwelcome sound.

A barking dog can sometimes be most annoying, and its efforts are often rewarded with rounds of abuse and physical violence. If, on the other hand, its barking has revealed the presence of a prospective burglar lurking in the shrubbery, one gives the dog a good feed and we say "good boy." Such is the perversity of human nature.

Acoustics today can be really considered a new science compared to what is was even twenty or thirty years ago.

So rapid has been the rise of the radio and electronic industry, so great has been the developments in the laboratories connected thereto, that many new things have been discovered which have proved our previous conceptions of the mattter as being mere guesswork.

Today sound waves are being put to a variety of uses. We put new tools into the hands of engineers, new instruments into the hands of musicians, while the physical sciences are using sound to delve deeper into the behavior of matter—living and dead.

Of all the devices used in these advances the microphone and vacuum tube are the two most important. Once the microphone picks up the waves of sound and converts them into electrical energy the thermionic valve is then used to accomplish an amazing variety of analyses.

Both these devices are used in complicated sound meters and other instruments for exact determination of vibration characteristics.

They have given us new data, revealed a great deal which was hitherto unknown and helped to correct old and mistaken ideas about sound.

POST OFFICE "BELS"

Now before we get involved in this discussion it is as well that we understand the two very important terms "bel" and "decibel."

The "bel" was a unit previously used to determine the rate of fading of signals sent over a telephone wire and was so named after Alexander Graham Bell, the inventor of the telephone. It is a power ratio 10 times that of a previous reference level. Two bels is 100 times zero level, three bels 1000 times zero level and so on. Thus each bel multiplies the power ten times.

The bel is divided into tenths called decibels and broadly speaking a decibel is the smallest difference which a keen ear can discern. The term "zero level" does not mean that there is no sound at that level. It could not be so, otherwise the other terms would bear no significance. If there were no sound at zero, then there could be no bels because, if you multiply nothing by ten or any other number, you still get nothing.

ZERO LEVEL

Zero level is simply a reference level just as zero on a centigrade thermometer is a reference level. On the thermometer there is temperature at zero and above and below it. Again, broadly speaking, zero level is just about the threshold of normal hearing. This is only true, however, for certain sound frequencies. Other frequencies have a threshold above zero and others below.

In order to get a better idea of

what a decibel represents George W. Gray devised a table of the sound equivalents of familiar sounds.

Ordinary breathing measured at a distance of 1ft is about 10 decibels. The rustle of leaves in a breeze is about 20 decibels or 10 times louder than breathing.

The average intensity of conversation is about 65 decibels. The noise made by turning the leaves of a newspaper is about 35 decibels.

Ordinary piano practice registers 75 decibels. A passing motor truck gives 80. A lion's roar 95. A steel rivetter 105.

The latter is the point at which the noise becomes painful. At near 130 decibels or ten million million times the zero point the noise become really painful.

Having now impressed firmly on the mind the meaning of bels and decibels we can return to our discussion of what has been recently found.

It has been the custom to define pitch, loudness and timbre of a tone in this fashion:

The pitch of a sound depends on the frequency of its vibrations. The loudness of a sound depends on the amplitude of its wave (the amount by which it causes the diaphragms of our ears to vibrate).

Timbre or tone depends on the shape of the wave.

These definitions are now found to be not quite correct. Dr. Harvey Fletcher, of the Bell Telephone Laboratories, has proved that a variation of any one of the three factors, frequency, amplitude and shape, can affect any one of the three tonal characteristics.

For example tones having a frequency of 200 cycles (about middle A on the piano) are very sensitive to changes in loudness. If this tone is amplified 100 times it is heard a semi-tone lower. Amplified further still it lowers in pitch still further. Thus amplification of this tone shifts the pitch from soprano toward the bass.

LOUDNESS

It has been found that, if a low-pitched tone of say, 100 cycles, is amplified in intensity, it increases in loudness much faster than a high-pitched tone. Thus, if a 100-cycle note is sounded at an intensity of 35 decibels it will have a sensation of loudness equal to a 1000 cycles note sounded at 60 decibels.

It was formerly thought that wave form alone determined whether a note of a certian frequency could be identified as being played by a violin, a piano or other instrument.

When violin music is played through an amplifying system it can be proved that no matter what amplification is used and no matter how loud it is reproduced the wave form of the tone remains the same. However, if the music is amplified to from 10 to 100 times, the loudness of the violin itself, loses its violin tone, and is not recognisable as such, even though the wave form remains unaltered.

These discoveries are beginning to be used in the making of new electronic musical instruments.

By the use of electronic devices many sounds in nature have revealed themselves, which are beyond the range of the human ear. The ear is not sensitive to frequencies above about 20,000 cycles per second.

Thus, many sounds in nature are inaudible to us because they are beyond this range. We can please ourselves whether we still call them "sounds."

There are some birds such as the American humming bird, which have a song beginning at a low register and rising in pitch until nothing is heard, although the bird's throat is still pulsing and his mouth is still open. He is obviously still emitting sound.

A peculiar kind of cricket also emits sound which is inaudible to the human ear.

This sound has been detected by Dr. George Pierce, at Harvard University in USA. By means of a very sensitive microphone capable of picking up the sound of a cricket at a distance of 900 feet and a special amplifving apparatus the sounds have been revealed. But if the sound is above the normal range of hearing of the human ear how do we hear the sound when reproduced through an amplifier. Very simply.

by Calvin Walters

Dr. Pierce calculated that if he combined with the vibration as picked up by the microphone from the cricket, another vibration of known frequency and then applied this combination to a detector he should get a note from the loudspeaker of a frequency equal to the difference between the known and the unknown. In other words he should get a beat note.

Thus, by analysing the frequency of the note from the speaker which was now audible and knowing the frequency of the vibration he mixed with the unknown, Dr. Pierce was able to determine the frequency of the sound from the cricket. This was found to be 32,000 cycles per second.

In the laboratory, "sounds" have been produced having a frequency of 2-million cycles per second and have been detected in the same way. It has been demonstrated that there are sounds in nature having a frequency of at least 40,000 cycles per second.

Even the blaze of a match which has just been struck and the noises which are made when the hands are lightly rubbed together have component frequencies beyond the range of the human ear.

ELECTRONIC EARS

It is the new electronic instruments which have furnished the acoustic technician with valuable tools with which to work. Such instruments as sound meters, filters, and analysers enable an engineer to design buildings which are acoustically as near perfect as possible.

There is a type of noise detector which keeps an ear on machinery such as power generators. The clearance between the rapidly revolving armature and the field coils are so close that any wear of the bearings may cause this armature to foul the coils with resultant extremely costly damage.

An electronic ear is installed, so that any unusual noise among the normal noises of a power station is heard immediately.

Many of the newer type "silent" electric fans, vacuum cleaners and the like have been designed by the aid of noise analysers. The noises which cause the greatest irritation have been detected and removed.

It is in the construction of auditoriums that the use of the electronic sound meter and kindred instruments have been most valuable.

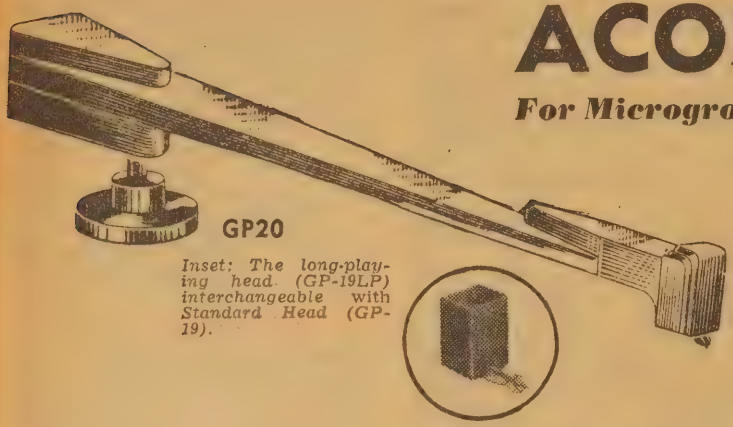
Acoustical treatment of buildings was at one time a matter of trial and error as carried out by Dr. Sabine at Harvard University over 40 years ago. The methods he used

The violin is one of the best known of all instruments. Recent research indicates that boosting the level of the violin renders its familiar tones progressively less recognisable, even though the wave form is preserved accurately.

The Finest Pick-up Available

ACOS G.P. 20

For Microgroove and Standard Recordings



GP20

Inset: The long-playing head (GP-19LP) interchangeable with Standard Head (GP-19).

GP20

The GP20 pick-up is designed for use with the standard 78 rpm records or the 33 1-3 or 45 rpm long-playing microgroove records. To meet these differing requirements, two interchangeable slide-on heads are available.

GP19 head supplied as standard.

GP19 L.P. head available for microgroove. It is something new in pick-up design and has 20 times greater output than comparable magnetic types, while needle talk and motor rumble are practically non-existent — permanent sapphire stylus — wide frequency response.

PRICE .. GP20, complete with standard head £6/3/6
PRICE .. GP19 LP head £3/11/-
PRICE .. GP19 standard head £3/11/-

GP10

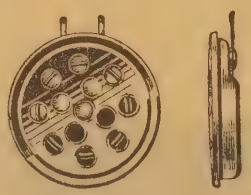
GP10

Sturdy construction, 90 degree lift back and exclusive needle pressure adjustment makes this a really outstanding unit in the field of pick-ups. Has a low harmonic distortion, with an average output of 1.5 volts.
PRICE, £3/2/9.
Cartridge only (GP9), price 36/9.

ACOS MICROPHONES and MIKE INSERTS

MIC 3

MIC3 Diaphragm-actuated Crystal microphone specially designed for the reproduction of speech frequencies. With rising response from 1000 c/s, this microphone has exceptional sensitivity.
PRICE, 39/3.



MIC 14

MIC14 Standard Speech Microphone itself with nickel-plate brass case which gives high corosion resistance; mechanical strength and rigidity.
PRICE, 39/3.

Ideal for . . .
Public Address: High output, light, yet rugged, may be adapted as a lapel mike.
Home Broadcasting: Exceptionally high gain allows direct use into pickup terminals.
Deaf Aids: Used by all leading Deaf-Aid Manufacturers.

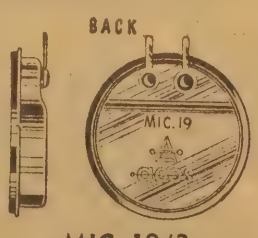
Combination Hand-Desk Microphone. Type MIC30

This latest Acos release is a superlative new Microphone designed for use as a hand or desk microphone, and also incorporates a metal loop to permit of hanging it in a convenient position. The microphone is extremely compact and light, weighing only 6½oz and the height is only 7in. At the thickest point it is 2¾in. tapering down to 1 1-8in at the base of the handle.

Price £9.7.6

MIC 18

MIC18 Microphone Speech Insert provides high acoustic qualities with minimum bulk. Where exceptional slimness is required this insert is recommended. .. .. .
PRICE, 39/6.



MIC 19/2

MIC19/2 Sintercel fulfils the requirement for a flat insert with good sensitivity and a frequency response 40/8000 c/s. Unaffected by vibration, exceptionally robust construction.
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bear detailing in order to show the great saving of time which the electronic sound meter of today saves the modern engineer.

A certain large lecture hall at the university was so bad acoustically that it was impossible to speak in it because of the great reverberation. Sounds became a jumble and hearing was impossible.

Dr. Sabine found that three things can happen to sound waves on collision with walls—(1) the surfaces may reflect the waves causing reverberation; (2) they may transmit the waves and the sound can be heard in the next room; (3) they may absorb waves and thereby reduce the overall intensity.

In this lecture hall every word uttered continued to echo back and forth for five seconds. The walls absorbed practically none.

Professor Sabine set up an organ pipe in the hall so that he could get a sound of constant pitch and loudness. He then borrowed all the cushions from the seats of a nearby theatre and placed them all over the seats of the hall. This reduced the reverberation time to two seconds showing that Sabine was on the right track.

He took a thousand more cushions, carpeted the floor with them, piled them against the walls, laid them all over the stage, built a scaffolding and lined the rear wall from floor to ceiling. This reduced the reverberation time to a little over one second.

After two years experimenting with different kinds of materials the professor recommended that certain wall areas be lined with felt. This was done and the lecture hall rendered serviceable.

This was the foundation of architectural acoustics, and with much more sensitive tools modern investigators have added to Sabine's work.

It is now recognised that reverberation is the factor which determines the acoustical quality of rooms and halls. This requirement varies with the purpose for which the room is to be used and the acoustical engineer has become a very important partner to the architect.

His methods are not, however, the trial and error ones of 40 years ago, but are highly scientific ones based on actual knowledge gained by means of the use of thermionic devices.

EFFECT OF AIR

Even the weather has an important bearing on the acoustic qualities of rooms. It has recently been discovered that dry air is extremely absorbent to certain high-pitched sounds and moist air is conductive.

Temperature is also an important factor. Very cold air is almost transparent to sound. As the temperature rises, the air becomes more and more absorptive until, at very high temperatures, it is so opaque to high frequency sound that these may be inaudible at a few feet.

The humidity of the air acts in a peculiar manner. Perfectly dry air is the most transparent. Air with 10 to 20 pc relative humidity is the most opaque and as the humidity rises the air becomes again more and more transparent until at 92 pc humidity it is back to normal transparency.

It has thus been found that in some cases the behavior of sound in a room may be influenced in many cases as much by the humidity as by the character of the wall surfaced. This is particularly true of high-pitched sounds.

Further to this has been the discovery that it is the oxygen in the air which is responsible for the sound absorption. In the presence of water vapor the oxygen molecules act in such a way as to absorb sound.

Carbon dioxide is a greater absorber than oxygen under the same conditions, but it is mainly the oxygen which is the chief offender. As we cannot get rid of the oxygen, the solution lies in reducing the humidity of the air in rooms by means of air conditioning.

So the science of sound progresses. New facts are frequently coming to light—a circumstance which has naturally stimulated the research into this science.

THIS ISN'T CRICKET, OLD CHAP!

The humble cricket is well known for his slithery feet, his appetite and chirp. He is also credited with a song too high in pitch for human ears to catch.

STANDARDISE AND SAVE MONEY

(Continued from Page 11)

consumers, and not by civil servants.

Britain has an excellent organisation for securing standardisation. The next stage, in a world where we hope trade will be freer and British exports will reach every country, is to secure international standardisation.

The waste resulting from its lack is excellently shown by the case of the screws I have mentioned. In fact, there have been a number of meetings of US, Canadian and British experts and it seems as if full agreement may come out of the war's experiences.

Every draft British standard is reviewed by each of the Dominions and changes which may make it more acceptable are discussed. The result has been agreement on a number of uniform specifications. The British Standards Institution maintains contact with every other national standardising body.

In Argentina there is a special committee that co-operates with the national standards organisation.

Translations of British standards are published in countries where they may be useful, such as Turkey. The Institution is a member of the International Standards Association, and although work in the international field has been retarded, there are now far greater possibilities.

In overseas trade, it is, perhaps, necessary to tread warily—variations in traditional practice, national custom and even religion, may result in prejudices against certain "standards" which, while "unreasonable," from a purely scientific point of view, have to be taken into consideration when the other man is paying the bill!

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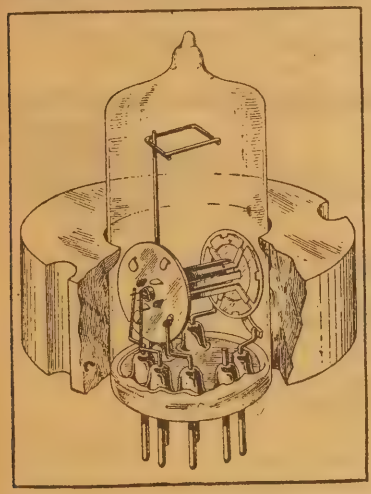
Technical Review

MINIATURE MAGNETRON TUNES TO 1000mc

Designed to fit a 7-pin miniature socket and capable of up to a half-watt output, a new baby magnetron may find wide application in UHF receivers. It will operate over the range of zero to 1000 Mc.

ORIGINALLY intended to deliver high pulsed power at UHF for radar applications, magnetrons have been successfully scaled down to operate as local oscillators in receivers. The latest effort, featured here, is a product of the General Electric Co., and is designated by the experimental type number Z-2061.

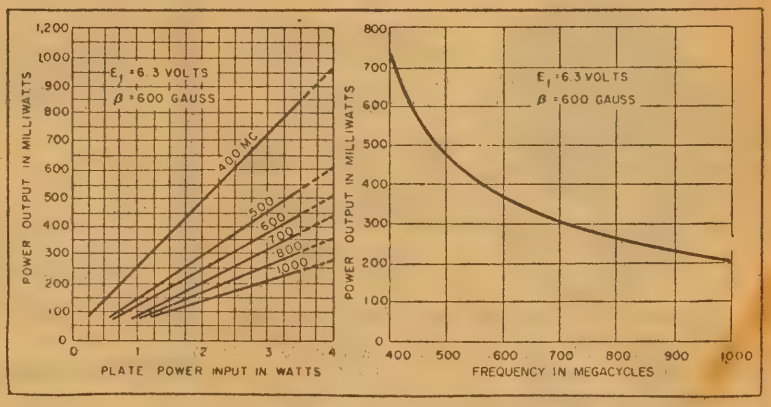
To date, triode oscillators have conventionally been used in UHF receivers and their performance is reasonable for frequencies up to



about 500 Mc. Beyond that, extreme care is necessary to maintain tolerances and the tubes become relatively expensive. This is likely to pose a severe problem in the design of UHF television receivers which may operate in the band between 475 and 890 Mc.

The magnetron structure, on the other hand, as indicated by the drawing above, is relatively simple, being essentially a multi-section diode with the plates arranged in a ring around a central, indirectly heated cathode.

A magnet is necessary around the base of the tube, giving a field strength of between 600 and 700 gauss, but no feedback provisions are required in the electrical circuit. The two ends of the frequency determining circuit are connected to the respective sets of anodes and the applied voltage gradually raised. Oscillation will ultimately occur at the circuit's natural resonant frequency.

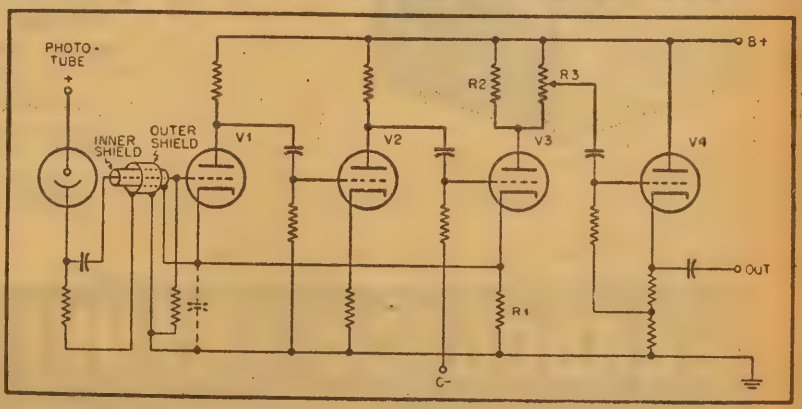


This mode of oscillation can be sustained to about 100 Mc. beyond which resort is made to "travelling wave" operation. Electrons are made to spiral outwards from the cathode, being influenced by several RF cycles before being actually collected.

By choice of suitable circuit constants, it is possible to generate oscillations from extremely low frequences to as high as 1000 Mc.

Experiments have indicated that the miniature magnetron is inherently quiet in operation, having a carrier-to-noise ratio approximately equal to that of a triode. (From Electronics).

NEW SCHEME SOLVES CABLE LOSSES



A recent U.S. patent, mentioned in "Audio Engineering" offers a neat solution to the familiar problem of cable losses with P.E. cells. Feedback between V3 and V1 makes the cathode potential of V1 almost equal to the grid potential. Since the inner shield is connected to cathode, there is very little capacitive current between the grid lead and shield, therefore a minimum of loss. At the same time the high impedance grid wire is shielded by the low impedance cathode circuit. An outer shield, connected to earth, has a small bypass effect on the cathode circuit, reduces degeneration and may even give a slight treble lift.

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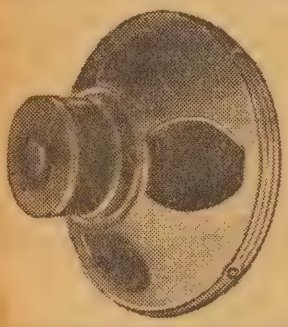

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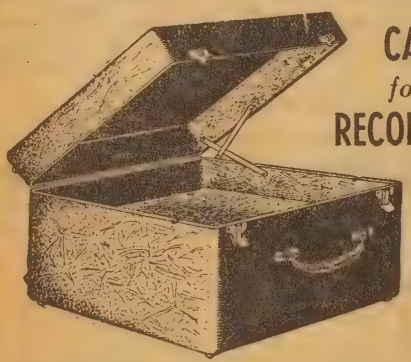

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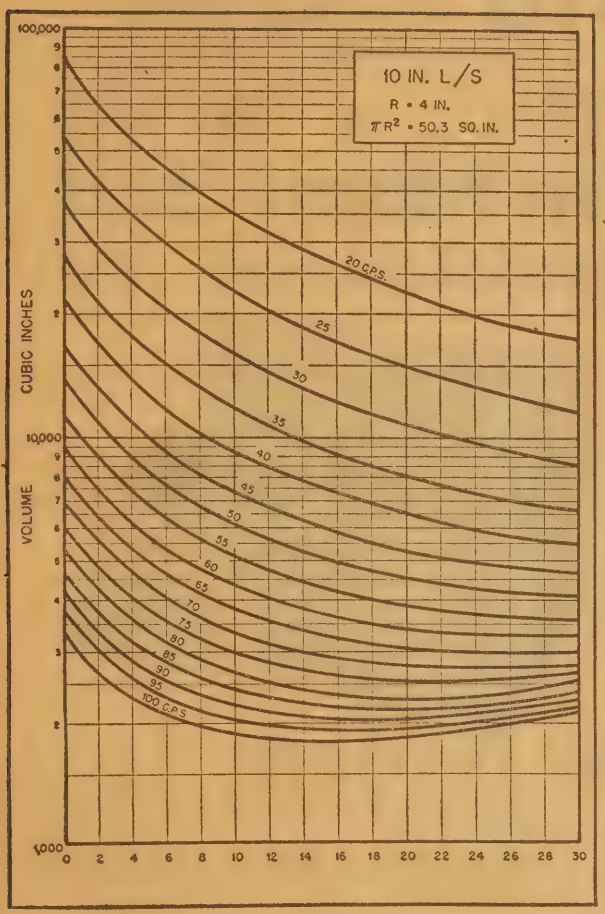
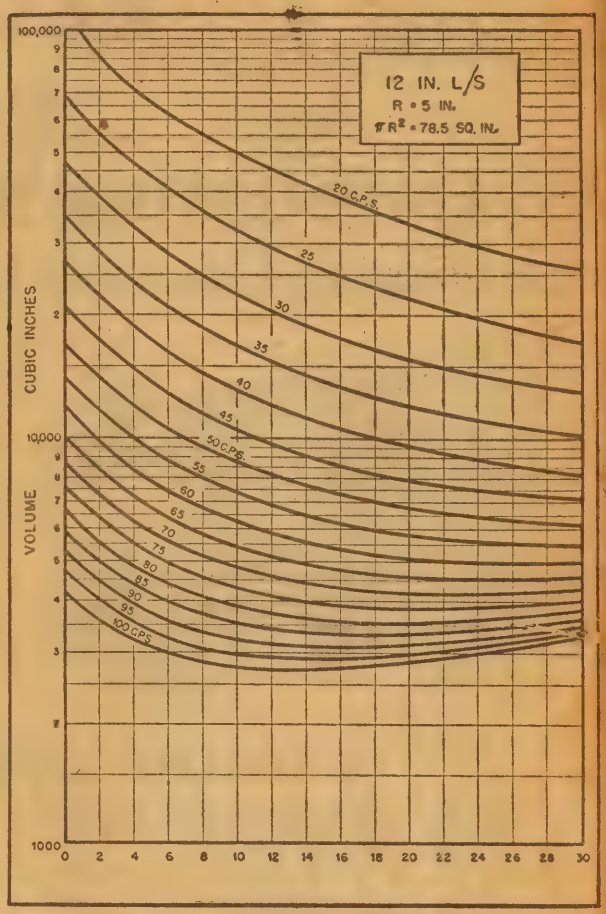
DESIGN DATA FOR VENTED ENCLOSURES





Curves (left) showing the tunnel length for 10" speakers resonant from 20 to 100 cps. On the right are curves for 12" speakers.

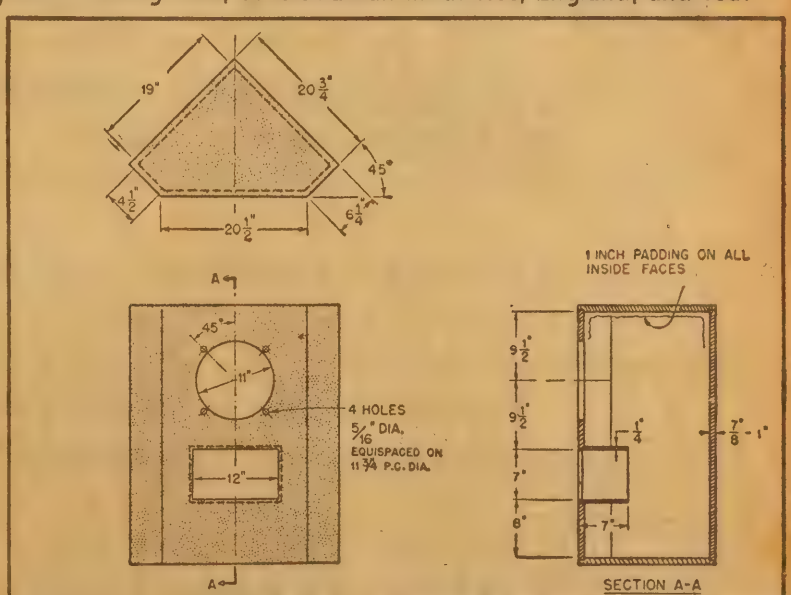
For those desiring to fabricate their own vented enclosure (or reflex baffle), a most useful set of curves has been developed by J. A. Youngmark, of Goodman Industries, England, and featured in "Audio Engineering." The curves for 10 and 12 inch diameter speakers are reproduced above.

IN reviewing the general situation regarding speaker baffles, the author points out that horn loading systems seldom fulfil theoretical requirements, because bulk and cost force the adoption of compromise designs. For general use in the home, the vented enclosure has much to recommend it, because it is simple and can be made fairly close to optimum requirements.

The advantages conferred by a properly proportioned enclosure are listed as follows: (1) Increased power handling capacity. (2) Less cone movement and therefore lower cone distortion at the speaker resonance. (3) Relatively compact. (4) Relatively free from phasing difficulties. (5) Not difficult to design and construct.

The vented enclosure consists of a solidly constructed box, which is rigid and airtight except for the

(Continued on Page 23)



A typical corner cabinet designed for a 12" Goodman speaker with a resonant frequency of 55 cps. For 75-cycle cones, omit the tunnel, leaving the plain front opening.

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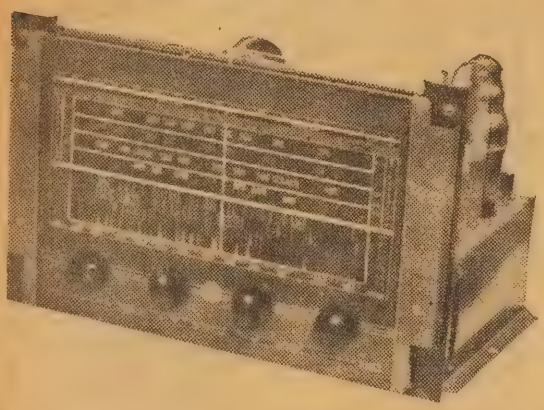

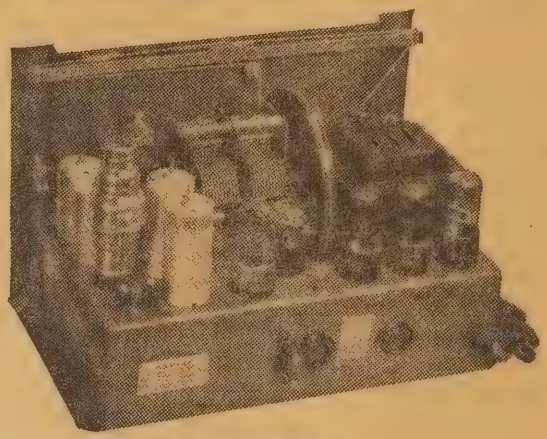

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DESIGN DATA FOR VENTED ENCLOSURES

(Continued from Page 21)

loudspeaker mounting hole and a vent of equal area adjacent to it. The vent may be a plain hole or may require to be backed by timberwork to form an open throat.

The length of the throat and internal cubic contents of the box determine its natural resonance frequency, which should be matched to the natural cone resonance of the selected speaker.

The steps in designing an enclosure are as follow:—

(1) Select the speaker and determine its bass resonant frequency by reference to the manufacturer or distributor.

(2) Decide on a suitable size for an enclosure. The exact shape is not critical, but long, narrow shapes should be avoided. Calculate the internal volume in cubic inches, subtracting the approximate volume of the speaker.

(3) Check this volume on the curves to note whether it cuts the speaker resonance curve at a point representing a practical length of throat. If the throat needs to be too short (less than the thickness of the front wood) your cabinet is too large. If the throat needs to be longer than about 6in, or protrudes close to the rear face, the cabinet is too small or too narrow.

The cabinet should be lined internally with a liberal layer of absorbent material and allowance made for the volume of this material when calculating net internal volume of the enclosure.

For those having a 12in Goodman speaker, the author developed a design for a corner cabinet which should meet many requirements and present optimum load conditions to the speaker in the bass register.

NEW RECORD SPEED

RUMORS of a new record speed have been cropping up at odd intervals over the past few months and these are now confirmed by an announcement by the Wagner Research Corporation of New York.

Their new record is designed to play at the extremely low speed of 16 revolutions per minute. It will be possible to play the new records, they claim, on a standard 33 1/3 rpm player with the help of a simple attachment.

The new records, of thin vinylite and 4¾ inches in diameter, will have 448 grooves to the inch and will play more than an hour (one half-hour per side).

This development is intended to be used for transcribing readings of classical literature, rather than for music. Work with the blind, according to the company's president, Robert Wagner, was the main inspiration behind the development.

The company intends to market the records for about one dollar each, and a kit containing two records and the attachment for a 33 1/3 rpm record player will probably cost about 12 dollars. Mr. Wagner said that the latest Zenith phonographs are also capable of playing at 16 rpm but will require a special stylus.

Doubtless "wow" will be a problem at this speed, but where speech only is to be handled this may not be serious.

NEW RCA 21-INCH KINESCOPE

The television industry's largest metal, rectangular picture tube, a 21-inch kinescope, has been announced by the RCA Tube Department. The new kinescope employs the metal-shell construction first introduced by RCA over two years ago as a major innovation in the 16-inch round metal tube.

THE new kinescope utilises the full screen area, producing a picture 18 3-8in wide by 13 15/16in high, with slightly curved sides and rounded corners. Providing pictures with high brightness and good uniformity of focus over the entire picture area, the tube has a white fluorescent screen on a relatively flat face made of frosted Filterglass, which minimises reflection of bright objects in the room and increases picture contrast.

AVOIDS WASTE

Conforming to proportions of the transmitted picture, the tube's rectangular shape avoids waste of screen area. This permits the use of a cabinet having about 20 pc less height than is required for a round-face tube providing pictures of the same width. In addition, the chassis need not be depressed or cut out under the face of the tube, and controls can be located as desired beneath the tube.

Employing magnetic focus and magnetic deflection, the new kinescope is designed with a funnel-to-neck section which facilitates centreing of the yoke on the neck. This feature, in combination with improved centreing of the beam inside the neck, contributes to the tube's good uniformity of focus.

Other features incorporated in the new 21in picture tube are short overall length, substantially lower weight than that of a similar all-glass tube, a higher quality faceplate than is commonly used in all-glass tubes and an ion-trap gun requiring only a single-field, external magnet.

IMPROVED FIRE EXTINGUISHER

AN improved dry chemical fire extinguisher is announced by a company in New York, USA. Called "Fire Killer," it spreads a dry powder over the flames. On contact with the blaze the powder gives off carbon dioxide gas, which puts out the fire. Since the powder is converted into a gas it leaves no stains on the materials that were burning. The company says that the device can be especially useful in warm climates as its powder will not evaporate.

NEWS AND VIEWS OF THE MONTH

Trade position

THE radio trade at the moment appears to be very much in the doldrums, with frequent mention of staff retrenchments.

That such a situation should arise is not altogether surprising, although its onset has been more abrupt than many expected.

For years now, our much-expanded radio factories have been pouring out large numbers of receivers, and, sooner or later, they had to overhaul the back-log of potential sales resulting from wartime restrictions.

With the "urgent" market filled, it looks very much like a return to prewar conditions, when sets had to be sold the hard way and sales were dependent on seasonal demands. In those days the effect was quite cyclic—"slack in summer, busy in winter."

Other important factors have been operating, of course. There has been an air of uncertainty for a long time about the future of FM and television, with the result that "canny" buyers have been holding off.

FM has largely disappeared from the public eye and now television has been officially relegated to some time in the indefinite future. Perhaps that should help a little.

Then there has been the impact of extra sales tax and this has coincided with the increase in "buyer resistance," evident in all avenues of trade. The public has a habit of remembering last year's prices and it takes a while to get used to the new ones.

Now it seems that import restrictions will cut across the one active aspect of the domestic radio market —the home record player. Most of the pickups, motors and records come from overseas, and, while the stock position is fair enough at the moment, the supply looks like drying up.

No wonder that trade executives are relying heavily on headache powders.

However one might explain or excuse the present slackness in the domestic set trade, there can be no argument that a well-established and cohesive electronic industry is vital to Australian needs and defence.

This point was put solidly before the Minister for Defence Production (Mr. Eric J. Harrison) by a deputation of the Radio and Telephone Manufacturers' Association.

Mr. Kennell, leader of the deputation, said later that Mr. Harrison had told the deputation that the Government would let contracts as soon as possible.

The deputation had told Mr. Harrison that, because of lack of defence contracts, the radio and telephone industry was slowly disintegrating under the pressure of sales tax and other Government regulations, Mr. Kennell said.

The sales tax and credit restrictions had caused the dismissal of thousands of workers.

The industry would have to dismiss many more skilled workers unless it received defence jobs.

Mr. Kennell said he told Mr. Harrison that the Government in 1950 had said that it regarded the radio and telephone industry as a key industry.

Mr. Harrison had promised to review the position urgently, Mr. Kennell added.

★ ★ ★

Television news

FOLLOWING the Postmaster-General's announcement that the TV plan was to be deferred, we heard it said in one quarter that this would put Australia way behind in the world picture, that we would never be able to catch up on countries which already had an established TV industry.

In actual fact, and strange as it may seem, the reverse is more likely to be nearer the truth.

England was first off the mark with a public television service and is now stuck with obsolescent standards and transmitters radiating different types of signal.

America benefited by her experience and has more advanced standards, but the US also is in the "soup." What looked like an ample number of channels throughout the VHF spectrum is now proved to be hopelessly inadequate. Very soon the FCC must make vital decisions with regard to UHF allocations and probably issue licenses for a whole new string of stations.

When this happens, viewers will

POPULAR SCIENCE QUIZ

Q. What is behind the use of the ultra-violet radiation lamp?

A. We are well aware that natural sunlight is virtually essential to maintenance of good health, not only in human beings but also in other forms of life. Of the rays emitted by the sun, the ultra-violet is the type which stimulates the body. It is responsible for the presence of appropriate vitamins in certain foods.

The ultra-violet ray has least penetrating power of those radiated by the sun. It causes what we call "sunburn" when we thoughtlessly expose our bodies too long to the unaccustomed rays of the sun.

Artificial ultra-violet radiation can be produced with the aid of the mercury-vapor and the carbon-arc lamps. It has been proved that controlled exposure to these radiations is quite beneficial in building up natural body resistance for prevention of, or as part of the treatment of certain ailments, particularly forms of dermatitis, septic wounds and even post-influenza debility.

Q. What are carbohydrates?

A. "Carbohydrates" is the scientific term for substances which are combinations of carbon and water. The most familiar of these would be sugars and starches.

Fats, carbohydrates and proteins are the three main types of food material required by the body. Whereas proteins go to make up living tissue, fats and carbohydrates provide the energy which is so necessary for us to go about our daily task. Fat, being somewhat of a versatile substance, can also build tissue as well as take the place of carbohydrates to some extent, where there is a deficiency in the food.

Before carbohydrates can act as fuel for the body, it must be changed into a sugar substance called glucose. This process is performed by the digestive system. Sometimes, when the digestive system is not functioning satisfactorily, glucose is taken directly because, not requiring any further change, it can be absorbed in that form into the bloodstream.

Q. What is meant by the term "creep" as applied to metals?

A. Everything man fashions from metal is under continual stress. Some is of natural origin, like gravity, wind pressure, &c. In machinery, other stresses tend to stretch, to compress, to bend or to twist components, while centrifugal force tries to tear things apart.

While metal parts may appear to suffer no distortion as a result of these forces, they do, indeed, exhibit a gradual change in shape and dimensions, even though of microscopic proportions.

In a soft metal such as lead, for instance, the distortion of shape is considerable and in some cases noticeable to the naked eye. Some change of shape takes place even in extremely hard metals. This distortion is called "creep."

In some cases, "creep" does not matter very much. However, in delicate machinery or in high-speed equipment it can be of vital importance. With the advance of industrial science, it has become essential to be able to measure such shape distortion with a very high degree of accuracy.

Experimental research has been able to raise this degree of accuracy of measurement of distortion from one-millionth part of a given length of metal per day to more than one hundred-millionth per day. This makes it possible to allow for a "creep" of something like one twenty-thousandth of an inch per annum in a 1ft length of steel.

have to equip their sets with adaptors or go without the new programs. With a color adaptor already seriously proposed, the space around the conventional US TV receiver looks like getting rather crowded.

A few years back, the whole idea of a domestic VHF receiver looked rather optimistic, but the tube position is altering rapidly. (Vide the miniature magnetron mentioned in our review columns.)

The longer we hold off, the nearer will overseas designers carry TV development to the stage which the AM receiver has long since reached —where it is good enough and cheap enough to meet the normal requirements of the service and the listener.

It may well be that, by the time Australia is ready again, to go ahead, the whole question of color and VHF propagation may have been resolved to the point where we shall know what is really wanted and what can be done. We may be well satisfied with the standards already proposed, or may deem it necessary to modify them in some degree.

All this, of course, has been said before, but it will remain fundamentally true while ever the art is undergoing such rapid development.

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Wrist watch radio

IT is somewhat humorous to note the regularity with which writers and salesmen "discover" the transistor and the germanium triode.

Every couple of weeks some enthusiastic bod. announces that a little gadget "the size of a pea" will do the job of a radio valve. Television sets shrink in a few seconds to the size of mantel receivers, radios grow on wrists, costs come down to a mere fraction of what they were, battery problems disappear and so on, ad lib.

Unfortunately, if you could leave the valves out of sets altogether, the remaining components would still take up a good deal of space, to say nothing of the big picture tubes and the big speakers that would appear to be a pre-requisite to high quality.

We're not suggesting that the transistor isn't important, even revolutionary, but it's still rather in the "De Forest Audion" stage.

Latest report, credited to RCA scientists, couples the transistor with a device which provides the necessary power to operate it from human body heat. The RCA boys probably know what they're talking about, but we doubt whether they could demonstrate a working model by tomorrow morning!

★ ★ ★

New jet engine

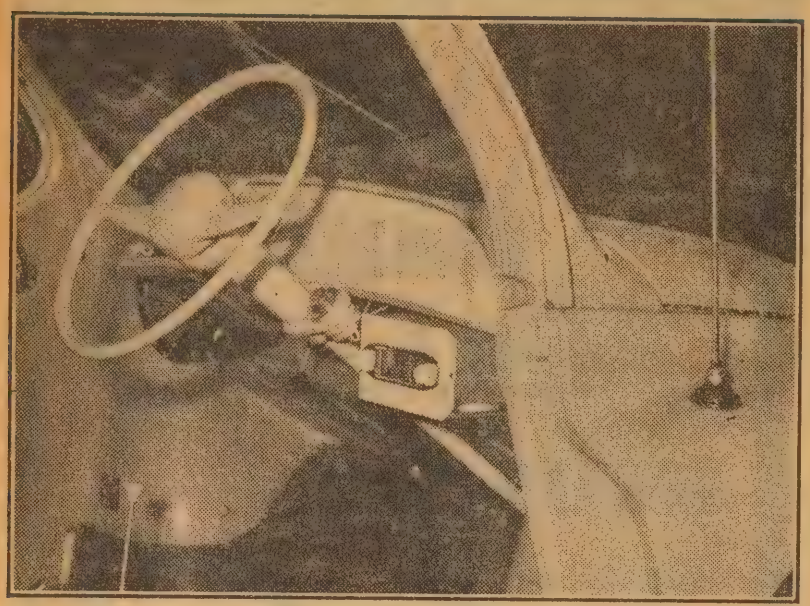
NEW secret jet engines are going into the latest airliner now on the drawing-boards of one of Britain's big air constructors.

These new jets are described by inventor Sir Frank Whittle as "the most important form of aircraft gas-turbine I know of."

Whittle recently secured a 10-year extension of the patent in them, when the court ruled they were of "exceptional inventive ingenuity and exceptional benefit to the public."

The new type is called a "by-pass" engine and employs a ductive fan.

Sir Frank Whittle himself considers it much more important than the straight turbo-jet (for his wartime invention of which re received a £100,000 sterling Government award).



A typical installation in a Renault car. Note the speaker under the dash on the passenger's side, the receiver being handy to the driver. The vibrator supply is in the front trunk, back-to-back with the set. Note also the single-hole mount aerial on the wing surface.

INSTALLING YOUR "KARSET"

The final and very important step for the constructors of the "R & H Karset" is the successful installation of the unit in the car. The effort which you are prepared to put into this job will largely govern the amount of pleasure you receive in return. This article, reprinted in part from the 1949 issue, is intended to lighten that task as much as possible.

by Raymond Howe

NOWADAYS, the installations of car receivers has been reduced by the experts to a comparatively simple routine. They have found answers to most of the problems and they know just what to expect and what to do with each particular make and model.

For the private individual lacking in such a background of experience, it resolves into a job of applying a general treatment and determining by trial and error which steps are necessary for his particular type of car.

STANDARD METHODS

Before proceeding, it is a good plan to get an idea of what is involved by inspecting as many commercial installations as possible to discover standard and well-tried methods.

Actual installation will necessitate a modest tool kit—spanners, pliers, soldering outfit, a breast or electric drill, files, and, last, but not least, a trouble light.

The first and obvious requirement is to decide upon the location of the receiver. As mentioned in the constructional article on the Karset, it can be fitted into the glove-box space or mounted behind the dash with just the knobs and the escutcheon plate protruding, the dial being viewed through an appropriate cutout. In some of the postwar models, a dash cutout is already available and covered with a decorative plate. With very little modification it can generally be made to fit the Karset dial.

Another favored position is below the lip of the dash with the controls within easy reach of the driver, and, preferably, on that side of the steering column which is closer to the intended mounting position of the aerial rod.

In one particular postwar small car the metal bottom of the parcel tray provides a handy mounting medium for this under-slung position. The vibrator unit may have to be accommodated on the motor side of the bulkhead or fire wall. This has some advantage, as it is frequently close to the car accumulator.

The receiver and power unit can be mounted separately or locked together in a suitable fashion, and mounted as a single unit. The latter arrangement will generally be preferred in large cars, the front end being supported by the instrument panel and the rear end by a bracket on the bulkhead. This bracket can well be the continuation of a strap rigidly securing both units together.

Such a strap will also electrically provide a bond between the cases and to the car chassis, and, consequently, it is necessary to see that the paint is scraped away from the points of contact around the bolt holes to avoid intermittent behavior.

SEPARATE POSITIONS

In small cars, the procedure will normally be to mount the receiver separately, having the vibrator unit nearby in a convenient position. It is most important to have an effective bond between the receiver and the vibrator unit case, either by a flexible strap or lead or by bonding each to the chassis or body of the car.

In the former case, it is not impossible to find that there is a variation in the level of vibrator interference with alteration of the point of bonding of the vibrator case. If this is so, the logical aim would be to select by experiment a point for bonding where any such interference is at a minimum. We did not encounter any problems of this nature with the 1952 Karset, but it is mentioned as an illustration of the type of treatment which is sometimes necessary in difficult cases.

It is important that the receiver make good contact with the chassis or frame of the car. Failure to observe this requirement can reduce the input voltage to the set and can complicate the job of eliminating ignition interference. In this latter case, only actual trial can establish the necessity for this provision.

As you are aware, the Karset provides for the loudspeaker as a separate unit. A bulkhead position may also be chosen for this especially if it is of the desired 7in or 8in size. It would be mounted, normally, in a suitable metal case.

SPEAKER BAFFLE

Some of the American cars provide for baffle-board mounting of the speaker behind the instrument panel grille. The oval type speakers are quite adaptable for this and similar positions. One or two large English cars already have speakers built in. If you are installing in

a comparatively new car, it would be wise to ascertain from the distributors whether there are any auto-radio accessories already provided.

Alternative practice is to use, say, a 5-inch speaker which can be fitted into the header bar over the windscreen. By cutting a hole in the header plate to allow the speaker magnet to protrude into the vacant space behind it, it is generally possible to have the front portion of the speaker protruding no more than about 1¼ inches. An ornamental bakelite or metal housing results in a neat and workmanlike appearance.

Acoustically, this arrangement has much to recommend it, especially for back seat passengers. But it should not be attempted unless you have proper mounting attachments or are prepared to make up a neat and generally acceptable substitute. There is at least one postwar small English car which already has provision for the mounting of a 5-inch speaker in this position.

SPEAKER LEAD

It has been mentioned in the constructional article on the Karset that, if you have the speaker transformer mounted on the speaker, it is wise to connect the speaker to the receiver through a run of shielded twin cable, bonding the shield to the receiver chassis. You will need to determine by trial and error whether the shield should be bonded to the car body at the other end or at intermediate points.

There is more than one way in which the receiver can pick up its supply from the car electrical system. The choice may be governed to some extent by treatment required in the elimination of ignition interference. We suggest that you try the simplest method first, but to be prepared to try another method if the elimination of ignition interference turns out to be difficult.

The simplest method involves connecting the active lead from the set directly to the ammeter terminal remote from the battery. The "earth" return is effected both by the normal contact between receiver and car chassis and by connecting the return lead to a lug under a handy frame bolt.

It is usually desirable to bypass the active feed point to the set to frame with a 0.5 mfd. paper condenser. If you have a larger one, so much the better.

AMMETER READING

With the set connected in this fashion, its drain will read on the ammeter and show the true balance of the electrical system at any time.

It is sometimes preferable to sacrifice this advantage and pick up the supply from a point nearer the battery. Thus, the active lead may be run through the bulkhead to the active side of the starter switch, a bypass being installed or not, as found necessary.

It may even be worthwhile to run the supply leads right back to the battery itself, thus avoiding any wiring common with the electrical system of the car.

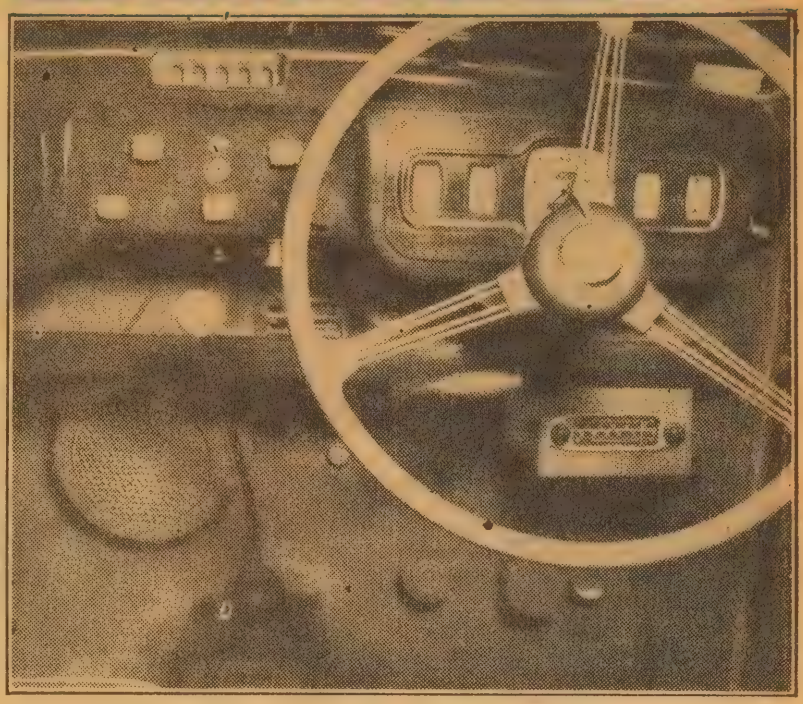
In the case of the Karset, the two return leads can also be run back to the "earth" battery lug making, in effect, a triple earth return—two leads back to the battery, plus the contact between receiver and instrument panel. Remember that the receiver drain will not register on the ammeter and you will need to allow for the 4-5 amps it is likely to draw.

It is assumed that your Karset has been arranged to suit the voltage rating of the electrical system of the car, as mentioned in the constructional article of the March, 1952 issue.

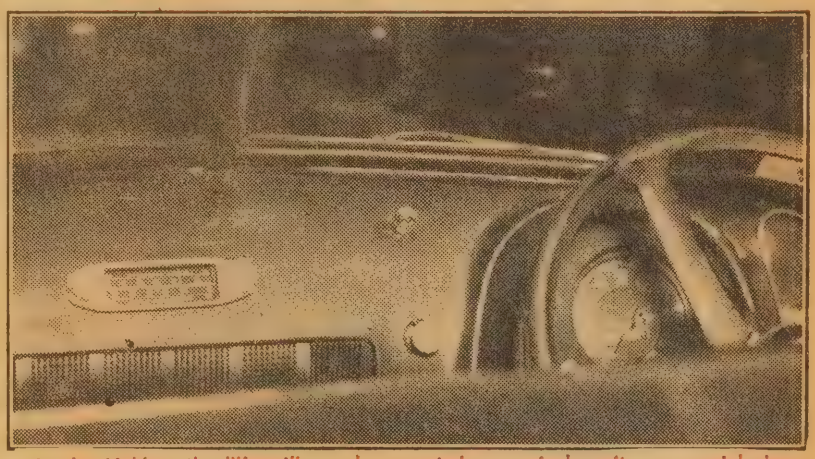
Also mentioned in that article was the method of adjustment of the polarity of the vibrator supply to suit the polarity of the car system. This involves the reversal of either the primary or secondary transformer connections—not both—to the vibrator socket so that the high tension output from the supply is positive with respect to the case or chassis of the set.

Either at this stage or later, switch on the receiver, the headlights and everything which would be used in night driving, and, with the motor running at a speed which would be equivalent to a car cruising speed of about 30 mph, see that the ammeter indicates an appropriate level of charge from the generator to the accumulator. If it shows a "discharge" or insufficient charge, the generator charging rate will need to be increased. The individual motorist can decide upon this after bearing

TWO TYPICAL INSTALLATIONS



The "Karset" installed in an Austin A-40. Here it hangs comfortably from the luggage tray above the driver's feet. This particular set was powered from an ex-disposal genemotor installed in the rear boot.



In the Holden, the "Karset" can be mounted as a single unit on a metal strap between the lip of the dash and the floor. The dial occupies the normal cut-out provided, but the speaker is best mounted in a metal cabinet on the bulkhead.

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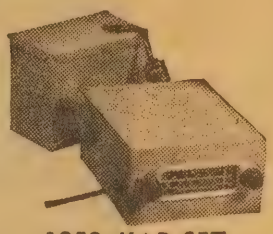
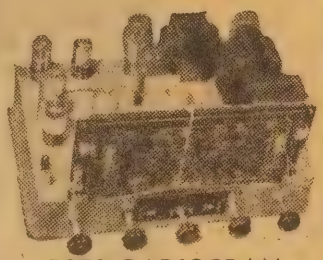
- 6 & 12 V. Inverters.
- Senior Radiogram.
- Inter-com. System.
- A.C. Power Supply.
- 1947 Advance.
- Fidelity 5.
- 32 Volt Set.
- 1952 Advance.

ETC. ETC. ETC.



1952 KAR-SET

JUBILEE PORTABLE



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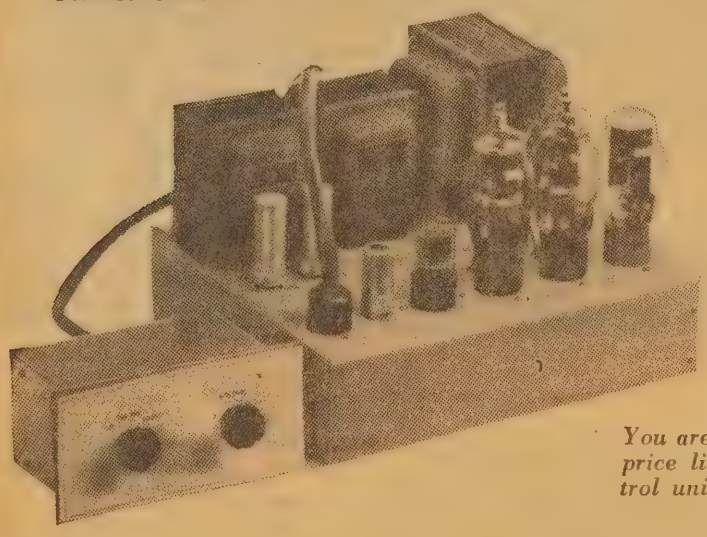

This range has been specially designed to provide high quality amplifiers with compensation for all types of records including long playing microgroove. Amplifier No. 4 is complete on one chassis, but Nos. 1, 2 and 3 are basic Amplifiers intended for use with the separate control units.

Amplifier No. 1 (R. & H. Oct. 1951) 18W. output.
Amplifier No. 2 (R. & H. Nov. 1951) 10W. output.
Amplifier No. 3 (R & H. Jan. 1952) 4W. output.
Amplifier No. 4 (R. & H. Dec. 1951) 4W. output.
Control Unit No. 1 (R. & H. Oct. 1951) for use with Amplifiers 1, 2, & 3.
Control Unit No. 2 (R. & H. Dec. 1951). This is a more elaborate unit than the No. 1 and provides extra bass and treble controls.

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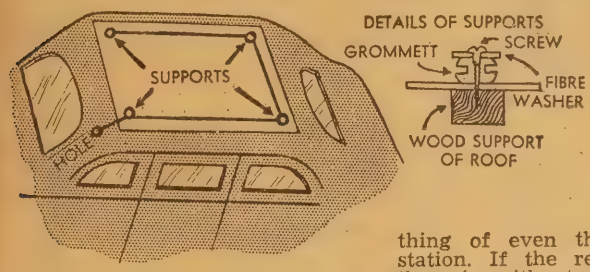
.....

in mind the type of use the car and radio is likely to receive.

As far as the aerial is concerned, several installations methods are possible. The main requisite is to obtain the maximum signal pick-up, farthest removed from the source of interference and to transfer the signal in the most efficient manner to the input of the receiver.

Fabric-topped tourers and roadsters are easily catered for with a length of ordinary insulated aerial wire run around beneath the lining of the hood. Fabric-topped sedans can be provided with an aerial in a somewhat similar fashion by lifting the fabric and installing an open spiral, or wire mesh, in the space immediately beneath it. However,



A simple aerial which can be used with a fabric-topped sedan. To save drilling the metal, the wire can be passed through one corner of the fabric, thence down the front pillar.

this is rather a hazardous operation for the inexperienced worker owing to the difficulty in making the covering smooth and watertight upon replacement.

Nevertheless, an aerial of this type is generally quite efficient and the Ford V8 cars of the mid-thirty vintage, for example, have such an aerial permanently built in. The lead to the receiver comes down through a low-capacitance shielded cable through the windscreen pillar on the passenger side. The same is true of many other cars of the same period, while a later example is the V8 Pilot.

All-steel turret-topped cars rendered such an aerial impractical. Underslung aerials have been used, and still are in some cases, but their reduced pick-up capabilities and the fact that they are exposed to the collection of mud and grease invariably turns the choice in favor of the modern type of vertically-mounted telescopic rod aerial.

AERIAL POSITION

Usual practice is to mount these aerials so that they stand vertically —or at a slight angle close to the windscreen pillar and usually on the driver's side so that it can be extended or retracted as required when driving.

You may find it worthwhile to connect the aerial temporarily to the set through a length of cable somewhat longer than that required for the actual installation and select a mounting position for the aerial on the car where the reception is about optimum consistent with mechanical logic. For each check position of the aerial, tune over the dial and assess the general performance.

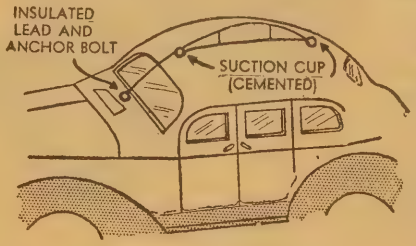
Two holes are required for mounting some aerials, one at the base and the other about a foot or so above it. Both mounting holes must be insulated where they pass through the car body and a shielded lead may be taken from either one to the aerial socket of the receiver.

Whichever aerial is used, it is most important from the point of view of eliminating ignition interference to couple it with only low capacitance shielded cable and bonding the shielding to the car body at the aerial end and to the receiver case at the other end. Whether it should be bonded to the car body at points en route can be decided by experiment only.

However, before actually connecting the aerial to the set, operate the receiver without an aerial, making sure that the shielding is pushed right along any protruding lead-in wire, although not actually shorting it.

With a well shielded set, you should be able to hear little or nothing of even the strongest local station. If the receiver will bring them in without an aerial, you can expect trouble. If it will pick up radio signals inside a car, be sure it will pick up far more effectively all the hash that is likewise found therein.

Now connect up the aerial, and operate the receiver. If possible, check the setting of the aerial trimmer at the high frequency end of the band, to make allowance for the capacitive loading of the aerial system. Choose a weak station where



Another type of roof-top aerial, now largely displaced by the vertical rod type.

the AVC action will not mask the peak.

Once the receiver itself is in place, there follows the big job of reducing interference. If the set is thoroughly shielded in itself, properly earthed, and efficiently coupled to the aerial, the battle is half won before you begin.

Start up the motor and listen for the ignition interference. It will be bad between stations, but you can feel pleased with yourself if the stronger locals can be tuned without ignition noise over-riding them.

You will probably notice that the noise increases at a particular motor speed, and a road test, at this stage, may show it to be worst, of all when the motor is pulling heavily.

You may or may not wish to fit spark-plug suppressors, but these will usually be found to reduce ignition interference. The exact effect on motor performance is always a point of debate.

Generally speaking, suppressors do not appear to affect a well-kept car to any perceptible degree. But, if the ignition system is in poor order —bad plugs, wiring, distributor, &c. —the suppressors may then have a noticeable effect. But the ignition system rather than the suppressors is to blame.

In some cases, a single suppressor fitted into the centre lug of the distributor is sufficient. In others, a suppressor on each individual plug gives better results. In still other instances, it will be found possible to minimise ignition interference sufficiently by other methods.

The phrase, "other methods," is extremely wide in its implications, involving suppression measures which may be directed only against the ignition system, or against other interference sources, or simultaneously against both.

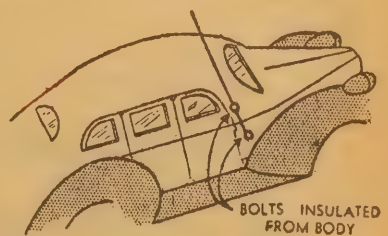
How much work you do will depend on how fussy you are, how far from the broadcast transmitters you normally drive, and the general characteristics of your car. For purely suburban running, you may be able to install the set, fit half a dozen suppressors and get satisfactory results. At the other extreme, go to as much trouble as you like to get your car silent—in the radio sense of the word.

CONDENSERS

In subsequent paragraphs, reference is made to bypass condensers. These can be of the ordinary 0.25 or 0.5 mfd paper tubular type, but radio condensers are not mechanically very suitable as they stand. Auto-type condensers are usually enclosed in a metal can, which connects to the "earthy" side of the condenser.

The can is fitted with a mounting lug, so that locking it beneath a body or engine bolt earths the can and one side of the condenser at the same time. The remaining lead goes to the point which it is desired to bypass. The condenser should be mounted as close as possible to this point to be most effective. Avoid unnecessarily hot positions, however.

Do not be daunted unduly by the formidable list of measures suggested for suppressing interference. Never are all of them necessary on any one car; the list is simply



A vertical rod or "whip" aerial, mounted by two pillars to the side of a car. These are often the best choice for older models lacking large horizontal surfaces.

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CL2

a general compilation of things which sometimes have to be done.

No one measure is likely to overcome all the trouble. Try the various things in turn, while the set is operating off-tune somewhere in the middle of the band. If a measure promises to cut interference perceptibly, make it a permanent installation. Quiet reception is the net result of many such small improvements.

Be prepared for surprises. Some suggestions for reducing interferences may actually increase it. Yes, even the addition of suppressors in some cars!

Remember, too, that the following suggestions are general, covering all makes of cars. They may or may not apply in detail to your own particular vehicle.

IGNITION NOISE

Ignition noise is evident as a regular plopping, in time with the firing of the cylinders. Common preventive measures are as follow:

Fit suppressor resistor to centre distributor terminal.

Fit suppressor resistors to all plugs.

Shield the HT lead from ignition coil to distributor, grounding the shielding.

Shield the aerial lead-in from the point of entry into the car interior, right to the set. Use low-capacity coaxial cable for preference.

Ground the metal case or cover of distributor to the engine block.

Bypass either one or both LT terminals on the ignition coil.

Bypass one or both terminals on the ammeter.

Bypass or filter the dome light lead, or install a new switch for it nearer the dash. This is essential with fabric-top sedans.

Provide a metal tube or other shielding to enclose the spark plug wiring, earthing the tube to the engine block. Already installed in many cars.

Remove low tension wiring, already in such a tube, leaving only the HT wiring enclosed. Tape LT wiring along the outside of the tube.

Shield leads to the ignition coil primary. Try reversing ignition coil primary wires.

Lengthen the distributor rotor with solder to reduce the length of spark.

Shield all low-tension wiring between the ignition coil, switch and ammeter, behind the dash.

REPAIRS

The generator is another potential source of interference which may vary from a rough sparking noise to a whine. Check this by revving the motor to a high speed, switch off the igintion and see if noise is still evident. Accepted measures are as follow:

Bypass generator output terminal.

Clean commutator with fine sandpaper.

Have commutator reconditioned and trued-up, also brushes.

Have insulation between segments slightly undercut.

By-pass one or both ammeter terminals.

By-pass cut-out terminal connecting through to the ammeter and battery.

Because the popularity or requirements of car radios were not foreseen, manufacturers have not always electrically bonded the various portions of a car framework.

Potentials can thus accumulate between various portions of the body and chassis and these potentials discharge periodically, producing interference not unlike ignition noise, but not possessing the same rhythmic beat dependent on motor speed. Scratching sounds may also result. Careful bonding may minimise ignition noise into the bargain!

Check the need for bonding by making firm contact between different parts with a stout, wooden-handled file. If permanent bonding is necessary, use woven copper strap of the heaviest practical type.

Bond to the bulkhead, all control rods which pass from the engine inside the car.

Bond the transmission and the exhaust muffler to the chassis.

Check earthing of the rain gutter around the hood, and the metal surround of the windscreen. Bond to frame if necessary.

In early models, bond body panels to chassis. Also the dash to chassis.

Bond steering column, dash, and chassis.

Ground door jams and window mechanism to the mounting pillar.

Bond rubber-mounted motors to the chassis.

ENGINE HOOD

Bond the engine hood to bulkhead.

Bond speedo-cable, oil-pressure line and fuel-gauge line (pneumatic type) to the instrument panel.

Bond the engine splash-pan to chassis.

And here are a variety of general precautions which may prove helpful in some obstinate cases:

By-pass starter switch on the starter side.

Ground securely the windscreen wiper (pneumatic tube).

Experiment with shielded aerial lead-in. Try intimate bonding to chassis frame, or bonding at each end only.

Bond metallic foot plates to chassis, or try an earthed sheet metal shield beneath the front mat—especially if noise increases when passenger occupies the front seat.

By-pass one or both sides of fuse holder.

Connect the receiver direct to the battery terminal, instead of via the ammeter. This point has been enlarged upon earlier in the article.

By-pass one or both sides of fuse and fuel gauge.

Re-wire the ignition switch to cut the "hot" side of the primary circuit, not the earthed side, as in some early models. Shorten the hot lead as far as possible, and shield in some cases.

Mount the ignition coil on the motor side of the bulkhead.

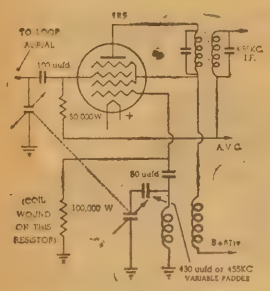
Try an ordinary 8mfd electrolytic from fuse block or ammeter "discharge" terminal to frame.

By-pass one or other cut-out terminal.

One final thought. Where practicable, make all your interference checks with the motor bonnet closed. It's surprising how often this is overlooked and equally surprising in the effect it can produce.

"Q PLUS"---0.1

MIDGET B/C OSCILLATOR COIL TO SUIT I.R. 5 CONVERTERS



Freq. Coverage
520—1600Kcs.
Tuning Capacity
25—445uufd.
(inc. strays)
Physical Size
Wound on I. R.C. ½-watt resistor, max. diameter approx. ⅜"
Mounting
RESISTOR LEADS which are used in circuit.

COLOR CODE
Blue=osc. pl.
Green=osc. G.
Red=B+
Black=E

Recommended Circuit

Primary L.—35uH.

Secondary L.—116uH.

Recommended Padder
430uufd.

Obtainable G. Current
.18 ma @ 520 Kcs.
.27 ma @ 1600 Kcs.

REMARKS

Essentially designed for inclusion in circuit wiring, rather than mounting separately.
Design assures oscillation even under low "A" battery conditions. Best results will be obtained with the padder placed as in recommended circuit above.
100,000 ½ watt Resistor upon which coil is wound may be used in circuit if desired.

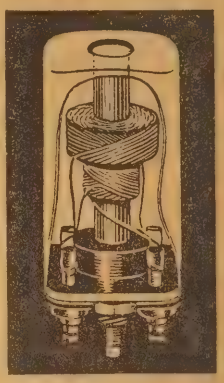
R. W. STEANE & CO. PTY. LTD., Auburn, Vic.

Due to prevailing conditions specifications may change slightly without notice.

"Q PLUS"---0.2

MIDGET B/C OSCILLATOR COIL

TO SUIT I.R.5, 6J8



Freq.Coverage—520—1600 Kcs.

Tuning Capacity—25—445uufd. (inc. strays)

Physical Size—¾" x ¾" x 1⅜"
Pin Connections

	1R5	6 J8
P=	Screen	Osc. plate
B+=	B+	B+
F=	Earth	Padder
G=	Grid	Grid

Mounting—3/16" Whit. nut onto moulded insert in base—template supplied.
Primary L.—20uH.
Secondary L.—when core adjusted to 1455 Kcs—116uH.
Recommended Padder—for 455 Kc I.F.'s 430uufd.
Obtainable Grid Current
.20 ma @ 520 Kcs.
.27 ma @ 1600 Kcs.

REMARKS

Litz wound secondary with special design to give constant grid current at recommended value.
Best results will be obtained by placing padder in series with gang condenser and coupling condenser and not between coil and earth.

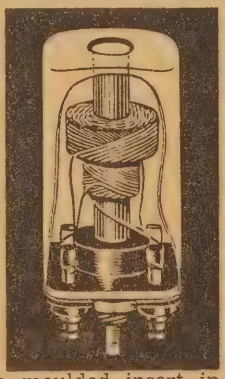
R. W. STEANE & CO. PTY. LTD., Auburn, Vic.

Due to prevailing conditions specifications may change slightly without notice.

"Q PLUS"---0.4

MIDGET B/C OSCILLATOR COIL

TO SUIT ECH33/35, X61M, 6AN7, 6AE8, etc.



Freq. Coverage—520—1600 Kcs.

Tuning Capacity—25—445uufd (inc. strays)

Physical Size—¾" x ¾" x 1⅜"

Pin Connections
P=Osc. Plate
B+=No connection
F=Padder
G=Osc. Grid.

Mounting—3/16" Whit. nut onto moulded insert in base.
Primary L.—13uH.
Secondary L.—when core adjusted to 1455 Kcs—116uH.
Recommended Padder—for 455 Kc I.F.'s—430uufd.
Obtainable Grid Current.
.20 ma @ 520 Kc.
.34 ma @ 1600 Kc.

REMARKS

Construction is similar to type .02. More consistent grid current results with the inclusion of a 2000w resistor between pin "P" and oscillator plate.

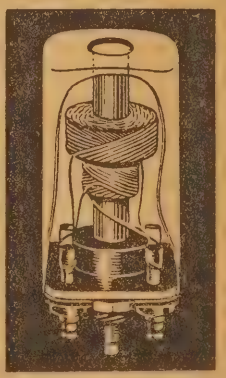
R. W. STEANE & CO. PTY. LTD., Auburn, Vic.

Due to prevailing conditions specifications may change slightly without notice.

"Q PLUS"---0.5

MIDGET B/C OSCILLATOR COIL

TO SUIT 6BE6 — 6SA7 CONVERTORS



Freq. Coverage—520—1600 Kcs.

Tuning Capacity—25—445uufd. (inc. strays)

Physical Size—¾" x ¾" x 1⅜"

Pin Connections
P=Cathode
B+=No connection
F=Earth
G=Osc. grid via padder

Mounting—3/16" Whit. nut onto moulded insert in base—template supplied.

Secondary L.—when core adjusted to 1455 Kcs.—116uH.

Recommended Padder—for 455 Kc I.F.'s—430uufd.

REMARKS

Special construction enables cathode voltage to be kept at a recommended value of 1.4 V.R.M.S. (Ref. Radiotronics Nos. 95 & 120) thus giving maximum conversion.

R. W. STEANE & CO. PTY. LTD., Auburn, Vic.

Due to prevailing conditions specifications may change slightly without notice.

A COURSE IN TELEVISION

PART 35—TELEVISION AERIAL SYSTEMS (CONT.)

By way of further information on the important subject, we reprint an article by Aerovox Engineers which explains the problems facing US television servicemen. Special reference is made to the wide-band beams made necessary by the diversity of stations in operation.

THE proper selection and erection of the antenna is one of the most important aspects of the installation of a television receiver. This is particularly true in fringe areas where the signal strength is marginal and a good antenna installation means the difference between high picture quality and "snow."

The antenna installation also presents a problem in economics for the television technician, since there is no substitute for quality in this phase of TV servicing. Many customer complaints and repeat service calls may be prevented by a safe and sound initial installation.

EFFECT OF LOCALITY

The antenna installation problems confronting the TV technician differ greatly according to the location of the installation with respect to the transmitter service area.

In the primary zone, reflections (ghosts) and omni-directional reception are major problems, while in the fringe areas high gain and low noise pick-up are the main considerations.

Since the primary service zone requirements are frequently fulfilled by simple indoor or built-in antennas, the problem of the greatest technical importance lies in the fringe area installation. This is especially true since a given transmitter in a populous area may serve many times as many fringe area receivers as primary zone sets. For this reason this discussion will be confined generally to the fringe-area installation.

The characteristics required of a TV antenna operating in a weak-signal area are as follows:

(a) High forward gain.
(b) High front-to-back gain ratio.
(c) Single major lobe directivity on all channels.
(d) Low-angle vertical directivity.
(e) Low wind resistance.
(f) A neat appearance.

PRACTICAL COMPROMISES

Not all commercially available antennas meet each of these requirements, although the most popular makes combine a reasonably satisfactory number of them.

In general, designs which employ separate antenna for the high and low television bands are capable of giving somewhat better performance than the all-band types, since certain compromises are necessary to achieve operation over the required 4:1 frequency range (54-216 mc).

However, the economy and simplicity of the all-channel designs, as well as their thoroughly satisfactory performance, makes them very popular for fringe-area reception. The simplicity of installation and maintenance of a type requiring only one lead-in usually more than compensates for the slight sacrifice in performance.

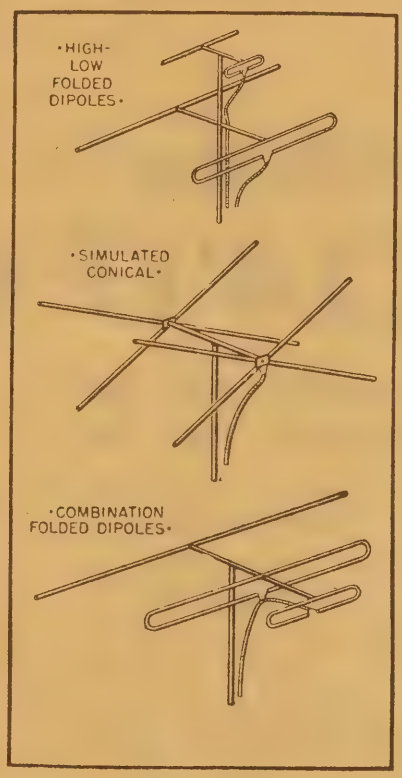


Figure 1: Aerial arrays like these are commonly seen atop American homes, particularly near the fringe of the service area. Simpler aerials suffice close to the stations.

Multi-element antennas are usually required for adequate reception in remote areas. The uni-directional properties of such designs are also desirable in reducing co-channel interference, which is more bothersome in fringe areas than in primary service zones, because the desired signals are weaker and the distance to the interfering station on the same channel may be much shorter.

For multi-channel operation, antennas utilising driven elements and reflectors are the most practical and are almost universally used. Antennas of the Yagi design, which use a reflector and one or more director elements, are usually not sufficiently broadband to receive more than a single channel.

A practical method of determining a suitable antenna type to use in a given locality (where this choice is left to the installer) consists of surveying the types already in popular use in that area. This usually serves as a reliable guide to the most practical kinds, as indicated by the experience of others. This procedure will also indicate the average mast height required.

Fig. 1 illustrates a few of the general types of TV antennas which have proven popular for secondary and fringe zone reception. The number of "bays" of these arrays which may be necessary for good reception is proportional to the air-line distance to the transmitter. As many as four bays may be necessary in very remote areas or in locations where intervening objects, such as hills, result in weak received signals.

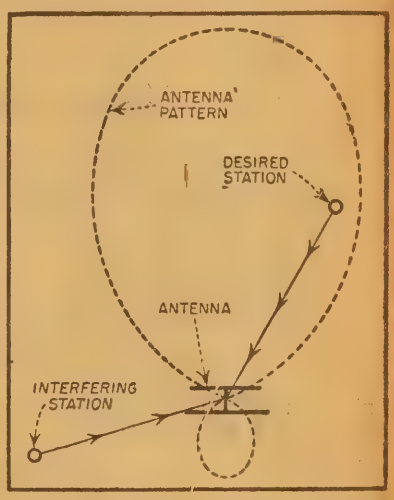


Figure 2: With a rotating aerial, it is possible often to select a direction which will allow the desired station to be received strongly, while rejecting the signal from an image or other source of interference.

Vertical "stacking" is usually employed, since this serves to lower the angle of maximum sensitivity to the angle just above the horizontal at which line-of-sight television signals arrive. Interference of the type known as "air-plane flutter" is also reduced by this measure.

A problem which sometimes faces the television technician concerns the necessity of incorporating an antenna rotator in the installation. Several makes of reliable electric rotators are available commercially, as well as convenient means of manual rotation in some installations.

Whether rotation is a necessity or merely a luxury depends again upon the service zone. In a locality where the transmitting stations lie in various directions, rotation may be required to receive all available sta-

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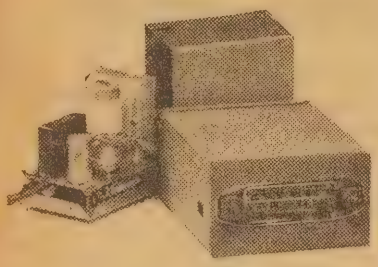

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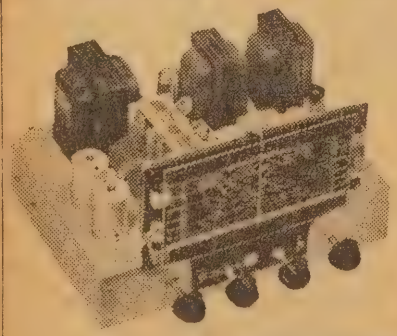

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tions. This solution is usually preferable to the use of separate antennas for each direction, and certainly has more "landlord appeal."

A rotator is a very useful adjunct to a fringe area TV installation, which is frequently bothered by co-channel interference. The ability to rotate the antenna sometimes makes it possible to eliminate the interfering station by placing it in a "null" of the antenna response pattern, as is shown in Fig. 2.

The same is frequently true of interference caused by local oscillator radiation from a neighboring television set. A position of the antenna can usually be found which greatly favors the desired signal while rejecting the interfering one.

One interesting system of manual antenna rotation used by a New Jersey experimenter consists of running the antenna mast through an unused fireplace chimney. The chimney provides support, so that no guying is necessary, and rotation is accomlished from the living-room by turning the mast in the fireplace.

The location of the antenna and its supporting mast on the roof or other structure, is important from the standpoint of ease of installation and subsequent performance. There are many considerations which the installer must keep in mind if the job is to be a practical one.

If the installtaion is in a rural area where there is little chance of reflections from large neighboring objects, such as buildings or mountains, there is probably no necessity of surveying the site to find a spot of suitable signal strength.

In such cases, the location will be dictated by such factors as availability of an anchoring structure, length of lead-in, distance from a highway or other sources of electrical noise, and others. On the other hand, if reflections are present, the actual location of the antenna should be decided by a field strength test.

Reflections cause various effects in television reception, depending upon the distance of the reflecting object. One readily recognised effect of such reflections is "ghost" images, which result when the reflected signal arrives with sufficient time delay to cause two or more identical images to be seen on the picture tube.

Reflections from objects which are too close to the antenna to produce "ghosts" are also important, since these cause standing waves in the space surrounding the antenna. If the antenna is located at a node of this standing wave pattern, it will receive much less signal than if it were located at an anti-node, or maxima.

As is shown in Fig. 3, the positions of maximum signal are located one-quarter wavelength on either side of the minima.

The importance of determining the antenna position by an actual field test is apparent. This survey may be conducted by using a field-strength meter, or by temporarily connecting the antenna to the set being installed and communicating between the set and the roof with a pair of sound-powered phones.

In a fringe service area the height of the receiving antenna is of extreme importance. For an antenna considerably beyond the normal line-of-sight, the field intensity of the receiving signal is increased approximately 10 times (10 db) each time the antenna elevation is tripled.

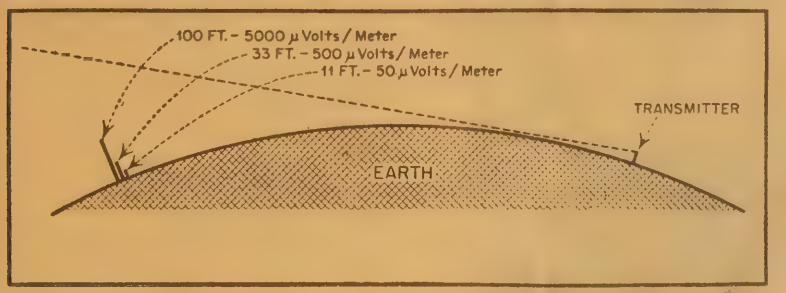

Figure 4: Illustrating a typical instance of how the height above ground for a receiving aerial affects signal strength. Installations on a hill top are at a great advantage when receiving distant stations.

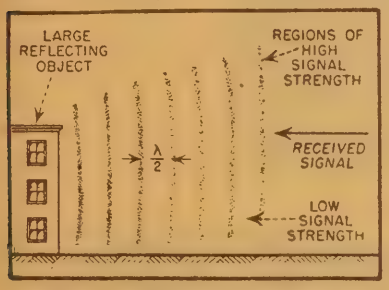

Figure 3: Illustrating how the standing wave effect in proximity to large reflecting surfaces can create alternate zones of weak and strong signal. Moving the aerial by just a few feet can make an enormous difference.

VALUE OF HEIGHT

Thus an antenna 100ft high would theoretically intercept 10 times as much signal as one mounted 33ft high, and 100 times as much as one 11ft from the ground level. See Fig. 4. The increase in signal-to-noise ratio in noisy localities is sometimes even greater, since each foot of altitude removes the antenna from the region of high man-made noise close to the ground.

Fringe area antenna installations range from about 30ft to 75ft in height, with extremes up to several hundred feet in remote mountainous areas. It must be borne in mind that high quality low-loss feedline must be used in such cases to avoid sacrificing most of the gain obtaineo by height in transmission line losses.

Raising a large outdoor antenna is a job for at least two men. Few individuals or commercial establishments can risk the personal danger and property damage made possible by attempting to do this work with insufficient help.

Most installation crews consist of three men: one to perform the inside

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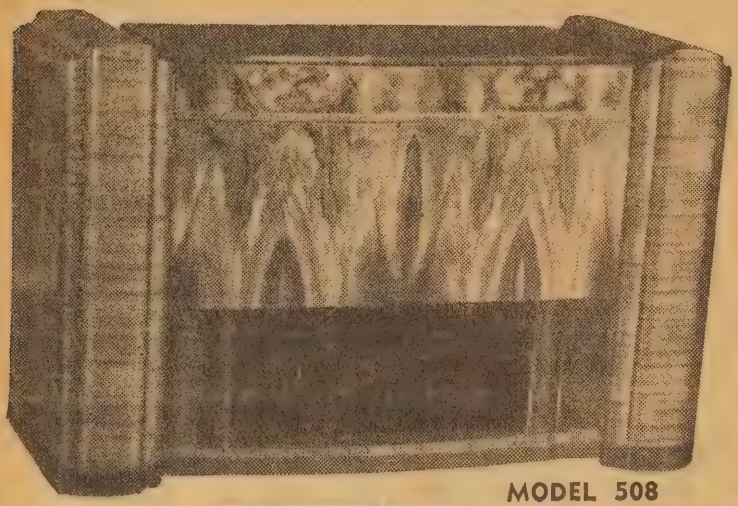

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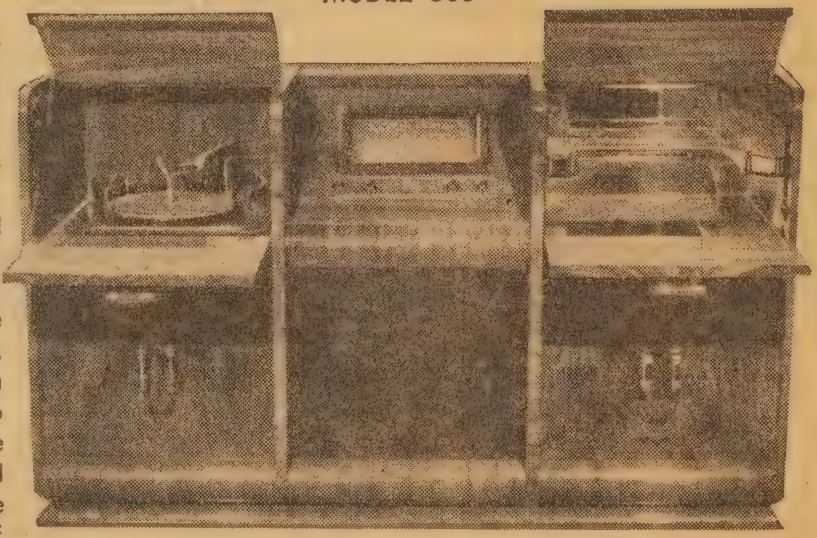

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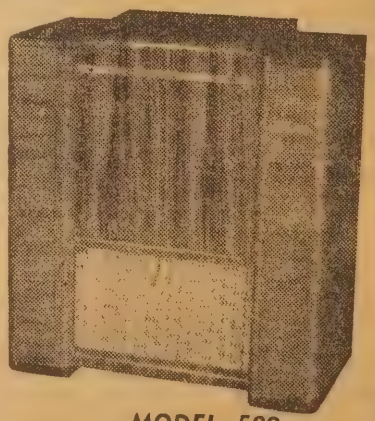

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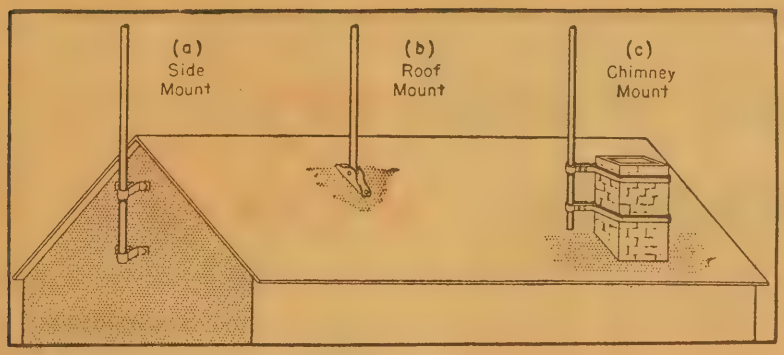


Figure 5: Typical methods by which aerial array masts can be mounted to the roof of a dwelling. In elevated locations an array can sometimes be mounted successfully underneath a tiled or slate roof, where it is physically protected.

installation and two others to assemble the antenna on the ground, attach guy wires and feedlines, install the antenna mounting bracket, and perform other outside work. When these phases are completed, all three concentrate on the erection and securing of the mast.

A wide variety of mounting brackets are available for anchoring the antenna mast to its supporting structure. The choice among these depends upon which part of the roof the antenna is to be mounted. Representative types are shown in Fig. 5.

Mounts which do not require making holes in the roofing, such as the chimney and side mounts, are highly

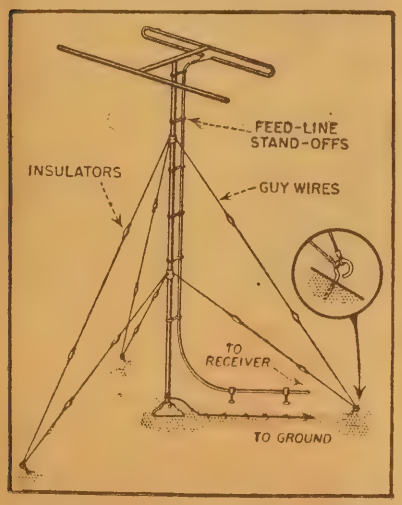


Figure 6: A typical method of guying for antenna masts. Large-scale TV dealers often employ a crew of aerial "riggers," who can be relied upon to effect a satisfactory installation. The set itself is handled by another member of the staff.

desirable where applicable, since there is less danger of causing expensive roof leaks. However, for most high antenna installations, the mast is mounted near the centre of the roof to allow sufficient guying points on the structure. In these cases, a roof mount (Fig. 5b) is employed, and is secured by wood screws or anchor bolts.

Each hole is sealed against leaks by applying a liberal coating of asphalt or plastic roofing cement around the screw heads and fittings. Zinc-clad marine hardware is preferable from the standroint of weather-resistance.

The use of guy wires is usually necessary with fringe zone antennas, due to the height required. Fig. 6 illustrates the proper method of guying an antenna structure. The wires consist of six or eight strands of No. 16 galvanised wire, and should be broken up with strain insulators at intervals so that the guy wire system does not act as a ground plane under the antenna and distort its pattern.

The guy wires should be fanned out at angles of about 120 degrees. Hooks or screw eyes for anchoring the guys should be placed before the mast is raised, and should be well sealed. These screws should be driven perpendicular to the pull of the guy wires rather than parallel (Fig. 6).

Before raising the antenna, it is good practice to fill the hole in the top of the metal mast with a dab of roofing cement to prevent water entering and also to prevent "howling" in strong winds. This is also done to the ends of antenna elements which are not already closed.

The electrical connections to the antenna may be sealed against corrosion with a silicone compound or with roofing cement after the terminal threads have been clinched with a pair of cutting pliers to prevent loosening.

INSULATION

Each terminal should be coated separately. Do not build up a conducting path between the terminals with materials of unknown electrical properties.

The antenna lead-in should be fastened to the side of the mast with the special stand-off insulators which are available for this purpose. Open wire "twin-lead" should not be allowed to lie closer than about 3in from metal surfaces for any appreciable distance, as this will change its impedance. Twin-lead is usually twisted to reduce noise and stray signal pick-up.

The use of coaxial cable is recommended in locations where noise is high or where salt fogs cause frequent TV "blackouts." If a rotator is used, enough slack must be provided in the feedline to allow 360-degree rotation.

Any antenna which even approaches the height of the highest surrounding objects must be provided with a ground connection for safety against lightning. A No. 6 copper or aluminium wire bonded to the base of the mast and run to the nearest ground will suffice.

Here's your answer, Tom!

In common with everybody starting out with radio as a hobby, Tom is having difficulty in sorting out in his mind the hundreds of different valve types. He has taken a step in the right direction by buying a valve data book but, without a background of experience, it is easy to come to some wrong conclusions—as evidence by some of the questions!

EVEN if he isn't a radio expert, Tom is wise enought to know that it is better to ask questions than to remain in ignorance, even if the questions do appear silly to the more enlightened. As you are able to understand more and more of these things, so you will find radio a more pleasurable hobby.

And so we come to Tom's first query: —

Why do you still use diode valves when there are better valves available?

This is the first point about which you are confused, Tom. It does not follow that a valve with more elements than another is necessarily better. Possibly it is able to be adapted to more jobs than another

valve but that is about all you can say.

One of the main uses of a diode valve is to rectify the alternating current from the supply mains. The ability of such a valve to pass an electric current in only one direction is the important one in this application. Additional grids would only be in the way.

Multi-element valves can be compared with diode valves in the same way that a 5-ton truck can be compared with the family car. The truck is certainly capable of carrying more weight than the car but our guess is that you would be in no doubt as to which vehicle to choose, if you wished to go for a Sunday drive.

I understand that a diode is a rectifier valve. How is it then that diodes are used for detection and for obtaining AVC?

That is quite an easy question to answer. The process of detection is essentially a process of rectification applied to the incoming signal voltage. The AVC control voltage is also obtained by rectifying the radio frequency carrier wave. In fact, these two processes are very much the same.

With the conventional diode detector arrangement, only the positive half-cycle excursions of the carrier are conducted and the resulting currents pass through a resistor known as the diode load. These currents through the diode load consist of very sharp pulses of energy which repeat themselves at the frequency of the carrier wave. This happens so quickly that neither the human ear nor any ordinary reproducing device is able to respond to them.

However, the ear is able to respond to the much slower average variations in the strength of the carrier which correspond to the modulation. By placing a condenser across the diode load we find that, due to ability of the condenser to store electrical energy, the voltage across the diode load now follows the average variation carrier strength with modulation.

In effect we have recovered the audio voltage which was originally combined with the carrier wave at the radio station. Going one step further, if the value of the condenser is made large enough, the voltage developed across a diode load will not follow the quick variations of the modulation, because the charge in the condenser will take a long time to build up and, having reached a maximum value, will take a long time to discharge.

However, the voltage across the load resistor may still be capable of varying in sympathy with slow changes in signal strength caused by fading. If this voltage be applied to the remote cut-off valves in early stages in the receiver, it is possible to make the audio output nearly constant, regardless of changes in the strength of the carrier over very wide limits.

Sometimes the one diode is used both for detection and to obtain the AVC voltage. It is set up in the normal detector arrangement but an additional high value resistor is wired between the unearthed end of the diode load and the high value condenser. The AVC voltage can be taken from across the latter condenser without affecting the efficiency of the circuit as a detector for the audio voltages. However, in certain cases there are advantages in having a separate diode for AVC purposes.

Could a modern set operate 100 pc without any diodes?

Only by a series of circuit "wangles," Tom. Even if it were a battery set using a biased triode detector, it would not be easy to provide AVC control voltage without a diode in some form, and no receiver could be considered 100 pc efficient these days unless it includes AVC.

A modern AC-operated receiver with a delayed AVC system would include at least four diode elements, although these may be inculded in only two valve envelopes.

Other than physical dimensions, do the 7- and 9-pin miniature valves have any advantages over the octal based series?

You will admit that the reduced dimensions certainly are a worthwhile advantage when it comes to laying out a neat and compact receiver, but, apart from this, the construction of the valves makes for mechanical rigidity which should enable them to hold their characteristics better when subjected to vibration.

The miniature construction also makes possible shorter leads than are possible with the octal series, which suggests that they have definite advantages at high frequencies. The valves use a considerably smaller

quantity of materials, besides not requiring a separate base. All this represents a considerable saving.

Manufacturers intend to make most of the new types in the miniature series so that the constructor will have more types to choose from in that series. Furthermore, in years to come you will be more likely to be able to obtain replacements in the new series.

Some valves have "sharp cut-off characteristics," according to

the data books, while others have "remote cut-off characteristics." How do you decide which type to use?

It isn't very difficult to give you the origin of the terms, Tom. In the case of a "sharp cut-off" valve, if after the valve has been set up for normal operating conditions, the grid bias is increased to greater than normal, the plate current of the valve will decrease proportionately. Eventually a point will be reached where the plate current will cut off quite abruptly.

If you impose the same conditions on a "remote cut-off" valve you will find that, as the negative grid bias is increased step by step, the decreases in plate current reduce much more gradually, with the result that a very much greater bias is required to make it stop altogether than in the case of the "sharp cut-off" type.

That explains the terms, but we still haven't come to the most important point. As the negative bias of the remote cut-off valve is increased, its tranconductance also becomes gradually less, and if you apply sufficiently high bias, the valve will cease to amplify at all.

This very useful characteristic, by the way, is achieved by a special construction of the grid of the valve. Instead of winding a perfectly even spiral some of the turns at the centre are spaced further apart than the rest making the centre part of the grid less effective than the ends.

A moderate negative bias prevents electrons flowing through the ends of the grid but very much more is required to prevent current from flowing through the centre of the grid.

If you use a valve having remote cut-off or variable mu characteristics in one of the amplifying stages of the receiver the negative voltage from the AVC circuit may be applied to its grid. As the strength of the carrier wave varies, so will the gain of the valve vary, tending to keep the volume the same. Sometimes two or more valves in a receiver will have AVC applied, making the control system even more effective.

What does the term "transconductance" mean? Is it a good idea to use a valve with a high transconductance or a low transconductance?

When the grid voltage of a valve is varied, the plate current varies in sympathy, as we have already noted. The ratio of a small change in plate current to the corresponding change in grid voltage is what is known as the transconductance.

As you can imagine, the less the required change in grid voltage for a given change in plate current, the more the valve is able to amplify.

In cases where high amplification is desired, you would generally choose a valve with a high transconductance. However, for practical reasons there is a limit to the transconductance that can usefully be employed. There are certain applications where a valve having a low transconductance is required. Sometimes it is better to use two valves with a low transconductance than one with a high transconductance.

Transconductance is a term that can be applied with equal justification to the effect of changes in screen grid or suppressor grid voltages on plate current. Where it is used without qualification, it may be taken that it refers to control grid-plate transconductance.

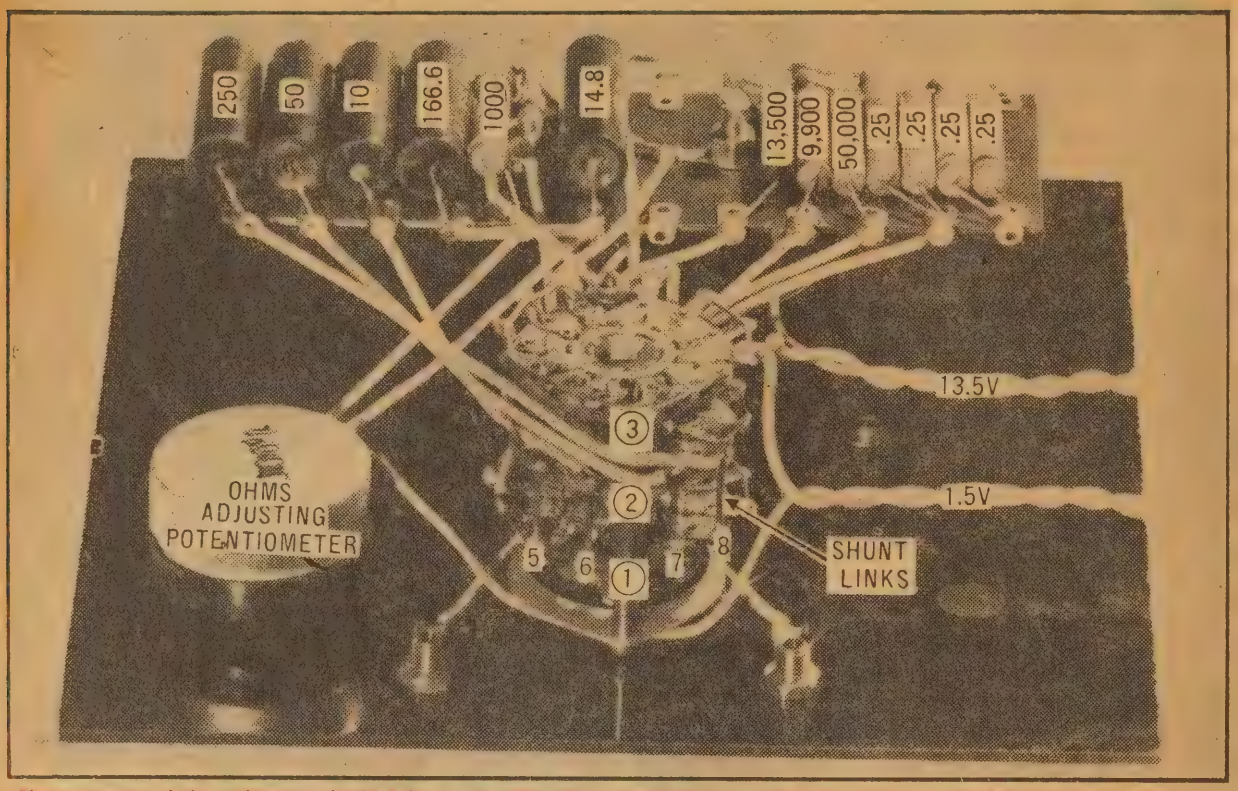
Sometimes engineers express transconductance in terms of so many mA/Volt, while others speak about a valve having a transconductance of so many "mhos." The mho is the unit of conductance, being the reciprocal of the ohm, the unit of resistance.

It is very easy to remember, because mho is simply ohm spelt backwards.

Why is the cathode bias resistor omitted from the audio output valve in some of your circuits?

As you have noted, Tom, a very frequently used arrangement for obtaining bias voltage for valves is to place a resistor between the cathode of the valve and ground. As the grid of the valve will be returned to earth, it will be negative with respect to the cathode by the same amount as the cathode is positive with respect to earth. A bypass condenser is connected across the resistor, so that it will not offer resistance to audio frequencies.

(Continued on Page 108)



This rear view of the multimeter should help you to follow the circuit diagram. Note the shunts on the left-hand side of the resistor panel, the leads running to the switch, and the links between the two lower decks. The opposite ends of the shunts are linked together and taken to the right-hand meter terminal.

LEARN WHILE YOU BUILD

Next to the voltmeter and ohmmeter the most useful section of our multimeter is the milliammeter section. In this article we explain how the basic sensitivity of the meter movement can be extended to cover the normal requirements of radio servicing.

THE value of current flowing in various parts of a receiver circuit can be extremely valuable in tracking down faults, and probably the only reason it is less popular than the voltage or resistance measurements is because it is not quite such a convenient measurement to make. This is due to the need to break the circuit and insert the meter "in series," so that the current flowing in that particular wire has to flow through the meter.

In order to get a clear picture of what we are measuring, it is necessary to emphasise those words "flow through," for current is just as much a flow as is the passage of water through a pipe. Thus, when the Water Board wants to know how much water flows on to your premises in a certain time, they cut the pipe and insert a meter so that the water must flow through the meter on its way to your tap.

One current range, 0-1 mA, is already available in the basic sensitivity of the meter, but this, while useful on odd occasions, is normally too sensitive to read the heavier currents normally found in a receiver. The maximum values would vary from about 40 mA. for a mantel set, or 70 for standard 5-valve model up to 200 or more, in the case of special amplifiers and similar equipment.

This coverage can normally be provided by adding three extra ranges to the 0-1 mA range, making four in all. Experience has shown that values of 10, 50 and 250 are the most suitable.

So much for what is required. Now to see how it can be done.

As before, it is best to return to the basic circuit and build our additional circuitry around it. Figure 1 shows a simple circuit, where a battery is used to force current through a valve, and the amount of current passed is indicated by a meter, which also forms part of the circuit. Assume at this stage that the battery voltage and valve operating conditions are such that the current flow is exactly 1 mA.

Next point to consider is that the meter has a definite value of resistance—100 ohms in this case—through which, at the moment, all the current is flowing.

by Philip Watson

PARALLEL RESISTOR

Now consider what would happen if a resistor, also of 100 ohms, were to be connected across the meter, as in figure 2. There will still be 1 mA. flowing in the circuit (the change in resistance is small relative to the total resistance of the circuit), but between points A and B there are now two paths through which it can flow—and both provide equal conductivity.

In these circumstances the current will divide so that .5 mA. will flow

through the meter and .5 through the resistor.

This process is known as "shunting" and the resistor is called a "shunt." It will be readily appreciated that the meter will now read full scale only when two milliamps are flowing in the circuit. Under these conditions, 1 mA. will flow through the meter and we may thus calibrate the meter exactly the same as if it were, in fact, a 2 mA. movement.

This, of course, is a simple case, where the value of the shunt was deliberately chosen to make the explanation easy to follow, but there is no reason why the value should not be so chosen as to multiply the range of the meter by any factor we require.

Returning to figure 2, we may visualise another 100 ohm resistor connected across the existing one, making the shunt value 50. Now there will be twice the conductivity in the shunt as there is in the meter, so that two-thirds of the current will flow through the shunt and one-third through the meter. Thus, the meter could be calibrated as for a 3 mA. movement.

NINE RESISTORS

Carrying this idea to its logical conclusion, we could connect 9 such resistors across the meter, making a shunt having 9 times the conductivity of the meter and passing 9 times as much current. If we now pass 10 mA. through the circuit, 9 of them will pass through the shunt and one through the meter, allowing us to calibrate the latter as a 10 mA. meter.

While the use of 9 resistors may help the reader to visualise the operation and calculation of a shunt it is, as you may have guessed, not the normal procedure. In the case we have been considering, we can divide the value of the single resistors (100 ohms) by the number of them (9) and obtain the total value of the shunt. This works out to 11.1 approximately and may be taken as the value of a single resistor required to shunt the meter to 10 times its basic sensitivity.

This brings us to the method normally adopted to calculate the value of shunts. From the value of the intended new range we subtract the amount of current which will pass through the meter. (1 mA in this case and, of course, both values must be in the same units.) Now we divide the remainder into the resistance of the meter and the answer is the value of our shunt.

Thus, for a 10 mA shunt to suit our 1 mA meter we first subtract 1 mA from 10 mA, leaving 9, which is then divided into 100. These are the same figures we obtained in our previous explanation and the answer will also be the same—11.1 ohms.

In the same way we can work out the value of the shunts required for the 50 and 250 mA ranges and you may find it interesting to try these for yourself.

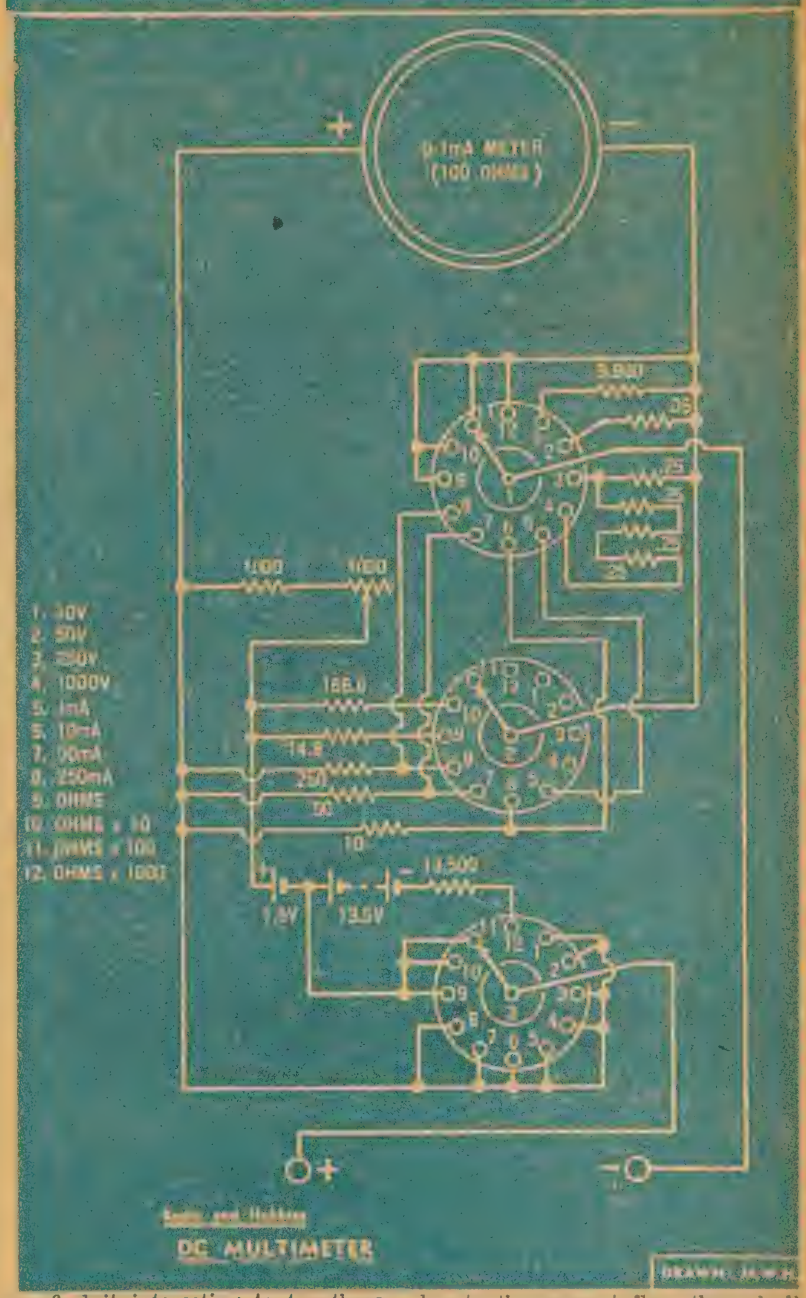
Actually, it is not essential to know these values for our present project because accurate shunts matched for a 100 ohm meter, can be obtained from the meter manufacturers. Nevertheless, the method is a valuable addition to your store of knowledge and it is quite likely that you will eventually need such calculations to enable you to make shunts to suit particular requirements.

Another method of looking at the operation of a shunt, and which may help those who have not quite grasped the idea, is to consider the meter as a voltmeter (remember we decided last month that it was a .1 voltmeter) which is being used to measure the voltage developed across the shunt due to the current flow through it. We can even base our calculations on this principle, providing we don't forget that a small part of the current still flows through the meter. In view of the simplicity of the previous formula there is really little point to it.

However, such a calculation may help to explain this idea, so we will consider the 250 mA shunt on this basis. What we require to know now is: What value of resistance will be required to develop .1 volt across it when it is passing 249 mA?

This resolves itself into a simple ohms law problem similar to those discussed last month, and may be expressed as: Resistance is equal to .1 (volt) divided by .249 (A) and gives a value of .401 ohm. Working

ADDING THE CURRENT RANGES



This circuit shows the additional wiring required for the current ranges, and comparison with the rear panel photograph should clarify any points in doubt. Note how the two decks are used to eliminate the effects of switch contact resistance.

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½ x 9/16	S.A.E.	3/8 x 5/16	S.A.E.
13/16 x 7/8	S.A.E.	5/8 x 9/16	S.A.E.
3/8 x 7/16	S.A.E.	3/16 x 1/4	Whit.
SET SPANNERS		3/8 x 5/16	Whit.
15/16 x 1	S.A.E.	1/8 x 3/16	Whit.
3/4 x 7/8	S.A.E.		
3/8 x 7/16	S.A.E.	1 pair Pliers.	
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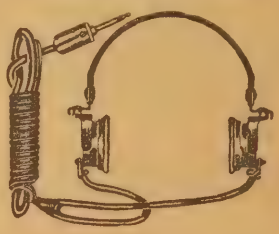

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the same problem out by the previous formula will give exactly the same answer.

When it is necessary to make a shunt there are two methods of tackling the job. One is to calculate the resistance required and then use an accurate bridge to wind such a resistor. Failing the bridge, it is sometimes possible to achieve reasonable accuracy by calculating the length of wire which will give the required resistance. The resistance per unit length of wire for various gauges can be obtained from wire tables.

The other method is to connect the meter in series with a standard meter of the wanted sensitivity and adjust the length of wire in the shunt until the two readings are identical. This latter arrangement is often the more convenient, particularly when the resistance of the meter is not known.

The wire most generally used is one of the forms of resistance wire, such as Eureka, Advance, Constantan or Manganin. The last material is also supplied in sheets, and is used in strip form in large shunts. A point to watch when soldering resistance wire is the effect of heat on any readings in the circuit at the time. Thus when adjusting the length of a shunt, misleading results will be obtained if the joint is not allowed to cool before readings are taken.

READERS are reminded that a printed card is available for the multimeter for 1/-. Lettering is white on a black background, so that the card can be attached to the panel and covered, preferably with a piece of celluloid.

This is due to the generation of voltage which occurs when two dissimilar metals are heated at their junction, sometimes referred to as the "thermocouple" effect. This effect is very pronounced when resistance wires are used in conjunction with copper and similar metals. Time can be saved by quenching the joint with methylated spirit, which will cool it rapidly.

The wires quoted have a very low temperature coefficient, that is to say, they do not vary very much in resistance value with changes in temperature. In many cases this is a very valuable feature, but it is not always so. Copper wire, which is used to wind the coil of the meter, has a relatively high temperature coefficient, something like .4 pc per degree Centigrade, which means that between summer and winter the resistance of such a winding could change from 4 to 6 pc.

TEMPERATURE ERROR

If the shunt across such a winding remains substantially constant, the reading will have this amount of error, which could be equivalent to plus or minus 3 pc if the calibration was done at a mid-temperature. This is not a serious error for radio servicing, but, where more accurate results are required, the shunt may also be wound from copper wire. In this case both it and the coil winding will vary at the same rate, and the error will cancel out.

On the other hand, any heating in the shunt due to the flow of current through it will cause a variation in resistance which is not reflected in the meter coil, and errors can be introduced in this way. Where copper shunts are used it is not normally difficult to make them heavy enough to prevent such heating, but it is essential to take such facts into account when they are being designed.

One point which has probably struck you about these shunt values is that they are frequently of a very low order, often amounting to no more than a small fraction of an ohm. This presents a special problem in the case of multimeters, where the various shunts are selected by switching, since the resistance of the switch contacts can quite easily equal a more than tolerable percentage of the shunt resistance.

To further complicate matters, this resistance cannot be taken as constant or be allowed for in the shunt value, since it will vary with the age and condition of the switch, and in a quite random fashion, due to many other factors.

Thus the most obvious method of switching shunts into the circuit, as shown in figure 2a, is seldom, if ever, satisfactory. This drawing shows the two points at which the most troublesome resistance usually occurs, namely, between the rotating "pip" and the particular contact it is engaging (A), and between the same pip (or the ring which forms a part of it) and the "common" contact (B). It is obvious how these resistances would be added to the value of the shunt.

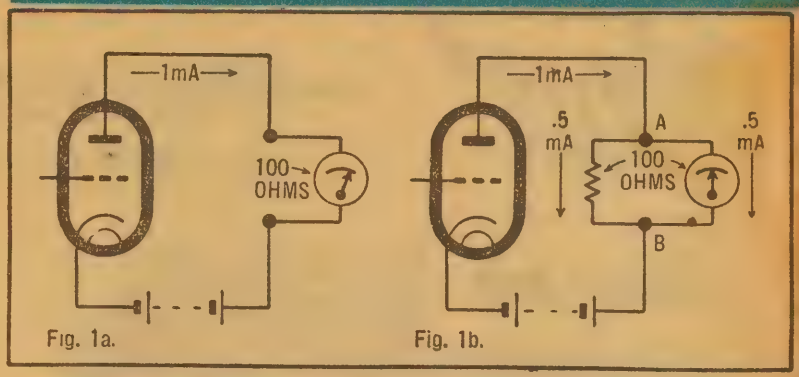
If we modily the circuit as in figure 2b these contact resistances will cease to be of importance, at least as far as the shunting effect on the meter is concerned, and will simply add to the resistance introduced into the external circuit by the meter. This is not likely to be of importance, since it is normally much less than that of the external circuit. However, such a modification is hardly practical since it implies that the meter will be permanently connected across one shunt.

SEPARATE CONTACTS

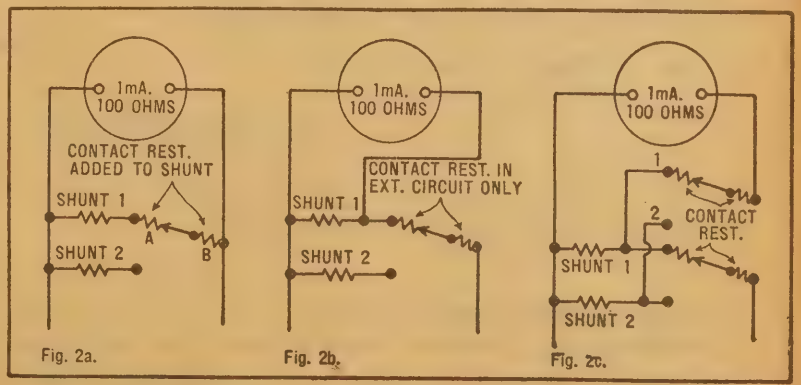
Figure 2 shows how this is overcome, a second set of switch contacts being used to connect the meter directly to each shunt resistor at the same time as the shunt is connected into the external circuit by the original switch section. Note that the second set of switch contacts is also assumed to have resistance, but this is of little importance, since it is normally low with reference to the meter resistance (100 ohms). It could be as high as one ohm, which is unlikely, and still only affect the overall accuracy by one pc.

Thus you will find that all shunt

ACTION OF A CURRENT SHUNT



Explaining the basic operation of a shunt. The range of the meter on the right is double that of the one on the left because only half the current in the rest of the circuit is allowed to flow through the meter. Extensions of this idea allow almost any range to be achieved with suitable value shunts.



Contact resistance in switches can cause serious errors in shunt circuits unless proper precautions are taken. The circuit on the extreme left is virtually useless since the contact resistance is added to the shunt value. The centre and right-hand diagrams explain how the circuit should be modified to eliminate this fault.

circuits of this kind switch these two sections, i.e., the external (current) circuit, and the meter (voltage) circuit, through separate switch contacts. Similarly, heavy duty shunts are always equipped with separate voltage and current terminals, in order to eliminate errors due to contact resistance. This is necessary, even though no switching is involved, the terminal resistance being sufficiently variable to cause trouble if it is not excluded from vital circuits.

LARGE SHUNTS

The accompanying photograph shows a typical example of this type of shunt, being one designed to produce 50 millivolts when 600 amps are passed through it. Note the large current terminals, which are duplicated further to reduce contact resistance and the smaller voltage terminals near the inner edge of each block.

The blocks are of brass, while the resistor proper is made up from the rods of resistance wire between them, there being 36 in all. The resistance can be calculated by ohms law and works out at .000083 ohm approximately. The need to eliminate the effects of contact resistance can be readily appreciated from this figure.

Coming back to values more in keeping with radio, let us now consider the fitting of shunts to our own

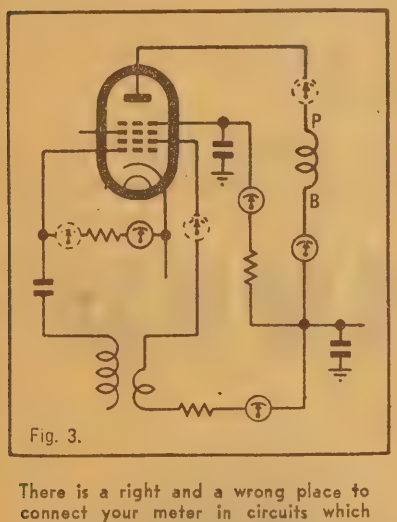


Fig. 3.

There is a right and a wrong place to connect your meter in circuits which are carrying radio frequencies. The solid meters show the correct positions and the dotted ones the incorrect positions in a typical frequency converter stage.

Volt-Ohm Meter. As mentioned earlier, the ranges selected are 10, 50, and 250 mA. and shunts for these are readily available from the meter manufacturers. If you have already purchased your meter and are ordering your shunts as separate items, be sure to specify the meter resistance, or its type number, if you are not sure of the exact value.

The shunts are mounted on the left hand end of the resistor panel, using the three remaining pairs of blank terminal lugs. The three lugs on the upper edge of the panel are connected together and wired to the next lug but one, i.e., the one that is connected to the meter positive terminal.

The switch positions are 5, 6, 7 and 8, No. 5 being the 1 mA. position. On No. 3 deck (furthest from the panel), these contacts must be linked together and also joined to contact No. 4. Both contacts No. 5, on decks 1 and 2, should be linked together, as should also the pairs 6, 7, and 8. From the last three links leads are taken to the lugs on the lower edge of the panel representing the 10, 50 and 250 mA. shunts.

With the aid of the circuit diagram and photograph you should be able to follow this wiring without any difficulty and have the job completed in less than half an hour. You can check the ranges with sufficient accuracy to show up any wiring errors, mixed shunt positions or incorrect shunts, with a simple battery resistor combination.

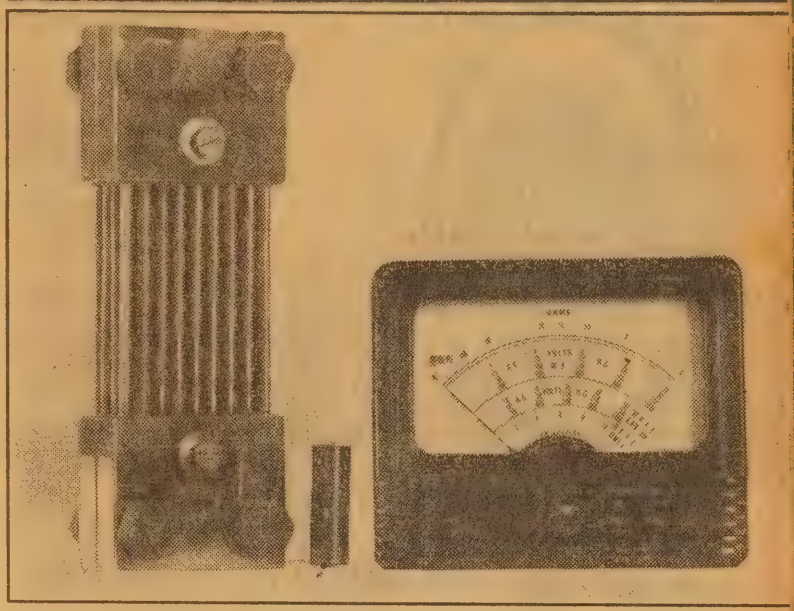
Using a 1.5 or 4.5 volt battery, select a resistor which will give a current of one milliamp. For example, a 1500 ohm resistor will be required for a 1.5 volt battery, although allowance must naturally be made for normal variations in these components. This value should be used to check all ranges, sufficient movement of the needle being possible to indicate that the ranges are approximately correct, while the meter will still be pr tected in the event of an open shu circuit.

If all is well you can consider rea ing some more useful values and, in the case of the ohms and vol ranges, the "Superhet. Four" or a other receiver which may be avai able is as good a guinea pig as y can get. To give you some idea wh to expect we are publishing the fi ures taken from the original "Supe het. Four," and which should be du licated fairly closely if you made th model. They will also serve as a gui for most other sets.

Some of the readings for t ECH35, notably the screen and o cillator plate, are higher than tho given in the valve data sheets. Th appears to be due solely to the cha acteristics of the particular valve our chassis, since there is no su gestion of over rating, all voltag being actually on the low side.

When making current measur ments it is not only necessary break the circuit but also, in son cases, to break it in the right plac

CURRENT SHUNT—LARGE & SMALL



You can try building a shunt like this into your multimeter if you like, but we don' recommend it! Designed to develop 50 mV when 600 amps are passed through it, i is used as a standard by one of our leading meter manufacturers. Beside it is a 250 mA shunt (in a moulded case) of the type used in this project.

PARTS LIST

1 0-1 mA, meter, 100 ohms internal resistance, universal scale S4-46A or similar, non steel calibration.
1 3 Bank 12 position switch with shorting type contacts.
6" of resistor strip having twelve contacts on each side.
1 Bakelite panel 8" x 7½" x ⅛"
1 1000 ohm potentiometer.
1 1000 ohm 1 watt resistor 10%
1 13.500 ohm 1 watt resistor 10%
1 14.8 ohm shunt
1 166.6 ohm shunt
1 950 type cell
1 703 type battery
1 Pair test leads
2 Tip jack sockets
3 Pointer knobs
1 9,900 ohm 1 watt carbon resistor 1%
1 50,000 ohm 1 watt carbon resistor 1%
4 250,000 ohm 1 watt carbon resistor 1%

ADDITIONAL PARTS FOR CURRENT RANGES

1 10 mA shunt
1 50 mA shunt
1 250 mA shunt
All matched for 100 ohm-1 mA meter.
Solder lugs, hook- up wire, nuts and bolts, etc.

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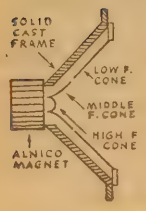

★ CONE HOUSING This is not a weak diecasting, or a flimsy steel pressing both of which produce unwanted resonances at certain frequencies, and the latter also creating magnetic field leakage. The "BAKER" Cone Housing is a thick sturdy aluminium casting, completely free from undesirable resonances and obviously free from magnetic leakage.

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This is particularly so in the RF, IF and oscillator sections of a receiver where the additional lead length can cause unwanted coupling, oscillation or lack of it as the case may be, and incorrect current conditions which are not indicative of the actual performance values when the meter is absent.

Take for example a converter stage as shown in figure 3. Here the pentode plate current may be read by inserting the meter either between the plate and the "P" terminal of the IF transformer or between the HT line and the "B" terminal. Normally the current flow will be the same at either point, but the insertion of long leads between the plate and the IF transformer would be quite likely to upset the operating conditions by causing oscillation.

On the HT side of the IF transformer there is no appreciable IF potential because the .1 mfd condenser from the HT line to chassis makes this point effectively at chassis potential at this frequency. Thus the meter may be inserted at this point without upsetting the operation of the circuit and the reading taken under normal conditions.

CURRENT READINGS FROM "SUPERHET FOUR"

Total HT	45	mA
Plate 6V6	38	"
Screen 6V6	2	"
Plate 6AR7 (min. volume)	.5	"
" " (max. volume)	5	"
Screen 6AR7 (min. volume)	0	"
" " (max. volume)	1.4	"
Plate ECH35 (min. volume)	.8	"
" " (max. volume)	2.4	"
Screen ECH35 (min volume)	4.5	"
" " (max. volume)	5.5	"
Osc. Plate ECH35	4.8	"
Osc. grid ECH35	.3 to .6	"

Screen circuits, being normally bypassed, do not present this problem, but it will be necessary to observe the same precautions with the plate circuit of the IF valve as well as the oscillator plate and grid circuits of the converter. For the latter the meter should be at the cathode end of the grid resistor rather than the grid end.

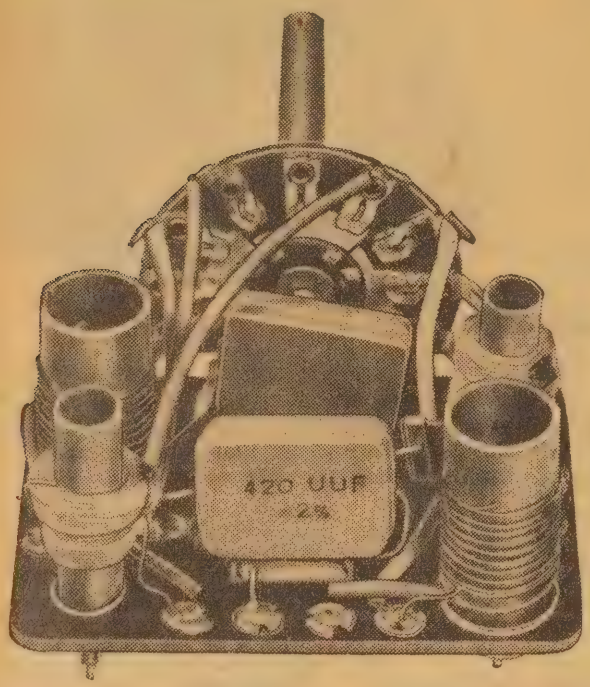
At other times the inductance of the meter coil can seriously upset the performance of a circuit, particularly where high frequencies are involved, and it becomes necessary to bypass the meter with suitable values of capacitance. This is especially so where the meter is being used at its basic sensitivity as might be the case where it is wired permanently into a transmitter circuit.

The addition of the shunts to our meter completes the DC portion of the instrument and, even if you do not care to add anything further to it for the present, you will find it an extremely valuable service aid. The ability to measure voltage, current and resistance is sufficient to track down most ordinary faults, once you have gained a little experience in typical circuit values.

Until you gain this experience the resistance, voltage, and current tables from these articles will serve as a useful guide. Although taken from a mantel set they will not differ greatly in larger models, except that HT voltage will be nearer the 250 mark and most current values slightly higher as a result. Next month we will discuss adding AC ranges to your meter.

New Products
by
BRAMCO

AS ILLUSTRATED



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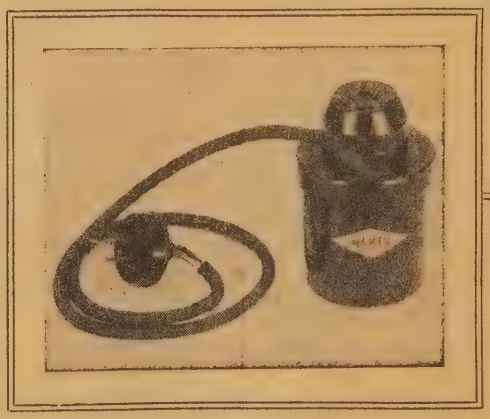

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FROM THE SERVICEMAN WHO TELLS

The test instrument I have selected for this month is the vacuum tube voltmeter or, as it is more commonly called the VTVM. Although perhaps bordering on the luxury class it has a very real value on the service bench and this article should help you select one most suited to your needs. The "case history," this month, deals with the mechanical aspect of receivers.

ANYONE who has used a standard type voltmeter for radio servicing hardly needs to be told the limitations of these devices. Excellent though they undoubtedly are for the routine type of service job they fall down badly in certain parts of the circuit and the trickier kind of fault, such as the intermittent, often finds them sadly lacking.

All this is brought about by the relatively low sensitivity of the meter movement, when we consider it in the light of the extremely high values of resistance and low values of current found in many parts of the set. This simply means that the meter needs more power to operate it than is available, or that it has a much lower resistance than the circuit (you can look at it whichever way you like). Thus, as soon as it is connected to the circuit that circuit ceases to function in the normal way.

This is a serious disadvantage when one needs to know the voltage applied to the plate, screen, or grid of a resistance-coupled stage, for the resistance is generally many times greater than that of the meter and the readings, at the best, can only be interpreted approximately and in the light of experience. While this may serve on occasions there are also the times when a more exact reading is essential, and this is where the VTVM scores.

OTHER METHODS

I am fully aware that there are other ways of obtaining this information and that the ingenious worker, lacking such a device, can substitute current readings and calculations, or similar methods, to achieve the same result.

Well, good luck to him, but the point is that such methods take time —and time to a serviceman is money.

Take, for example, an AVC circuit. In a set with an intermittent fault much useful information can be obtained by placing this section under observation, for it will quickly indicate which half of the set contains the fault.

There are two ways of doing this, either by measuring the cathode current of the IF valve or measuring the actual AVC voltage with the VTVM. Both will give essentially the same result, but if you have ever delved into the "innards" of a compact mantel set to get at the vital socket pin you will realise that the VTVM method is immeasurably superior.

As well as reading DC with a minimum of loading, a well-designed instrument should handle AC over the entire audio range and up to, say, 100 Kc with sufficient accuracy for ordinary purposes. When some form of probe is added the range of the instrument may be extended to cover the medium and high radio frequencies.

The ability to cover the audio range is extremely valuable for the testing of pickups and similar audio devices both for voltage output and frequency resonance, while frequency compensating networks and filter circuits may be easily adjusted, even when the main amplifier is not available.

The VTVM has another advantage which is frequently overlooked. Have you ever tried to read the HT voltage in a set only to discover too late that the meter has been set to the 10 volt range instead of the 1000, or, worse still, one of the ohms ranges? If you have (and who hasn't?) you have probably gazed sadly at the mutilated pointer and longer for a device to protect the poor inoffensive thing.

PROTECTS METER

Well, the VTVM does just that. Because the meter is in the plate circuit of a valve and there is definite limit to the amount of current which will flow in a valve, it is impossible to pass more than this amount through the meter, no matter what voltage is applied to the valve grid.

With most designs this maximum is no more than two or three times the full scale current of the meter and any meter worthy of the name can stand this overload without even a flutter of its hairspring. So, if you're a regular meter basher the VTVM might justify its existence on this score alone.

Most servicemen will have a rough idea of the basic principle of these devices and would probably describe it as a valve with a meter in the plate circuit and to the grid of which the unknown voltage is applied.

HIGH IMPEDANCE

In general this is correct, the idea being that the grid circuit of a valve can be made to have a very high resistance, or high enough to prevent any serious loading of the circuit. The meter in the plate circuit is completely isolated, as far as loading is concerned, but responds to the voltage on the grid by virtue of its effect on the plate current. Of course, the meter scale will be calibrated to correspond to the voltage applied to the grid.

While that is a general picture, there are many finer details which must be appreciated if one is to be in a position to select the type best suited to a particular need. Figure 1 shows what is about the simplest type, but even this would require a number of refinements to make it a practical instrument. In order to appreciate how the modern version has been developed I suggest that you consider some of the characteristics of this simple circuit.

First we have the input resistor in the grid circuit of the valve. This will obviously be placed across the circuit under test and, unless it is of a sufficiently high value, it will load the circuit in just the same way as a standard meter.

UP TO 10 MEGS.

In practice it is possible to give this a value of at least 10 megohms and sometimes higher, where special precautions are taken. Main limitation is the effect of grid current which generates a certain amount of bias across the high resistance and which is removed when the circuit under test provides a lower resistance shunt path. This causes a slight change of calibration according to the value of the shunt path.

When it is necessary to increase the range of the instrument it is generally most satisfactory to make the grid resistor into a form of voltage divider, tapping the grid down toward the earthed end in steps according to the multiplying factor required. (Fig. 1b.)

The cathode resistor appears to be about the best method of obtaining bias, fixed bias sources rendering the instrument unduly sensitive to

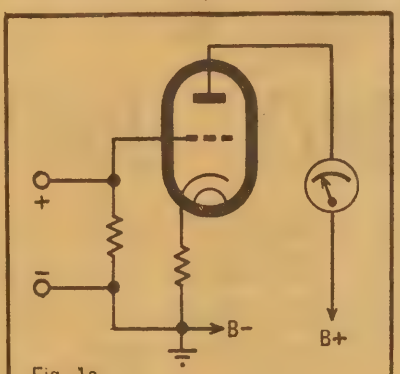


Fig. 1a.

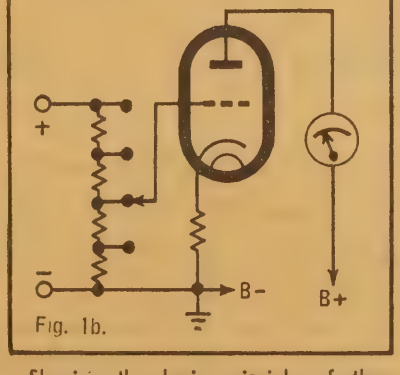


Fig. 1b.

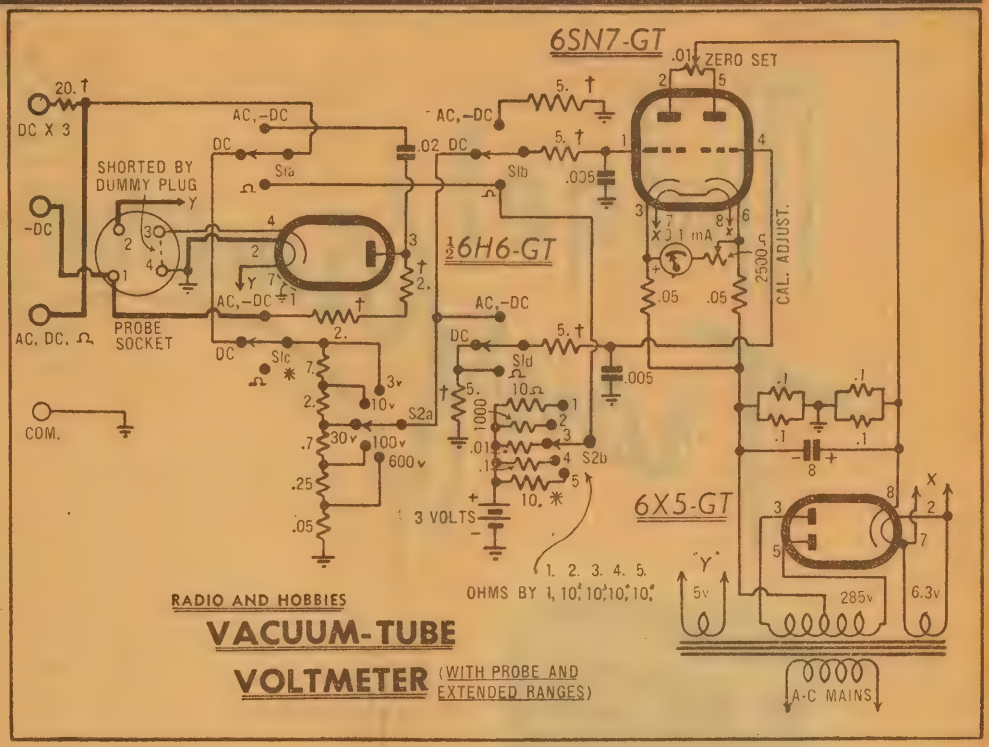
Showing the basic principle of the VTVM and (figure 1b) how additional ranges are added. While useful for the experimenter these simple devices have a number of limitations when considered in the light of a serviceman's requirements.

V-T VOLTMETER CAN BE BUILT ON THE BENCH

A typical VTVM designed for home construction. It has most of features of a commercial instrument but will cost considerably less if you have the time to make it. The circuit is not complicated and should present no particular problems to anyone accustomed to working from circuit diagrams.

★

Illustrating the basic principle of the balanced bridge type VTVM, this diagram breaks the circuit down to bare essentials. Such problems as meter standing current, non-linear scales, and earthed input are overcome by this method and the cost is not much greater than the single valve type. Compare it with the complete circuit.



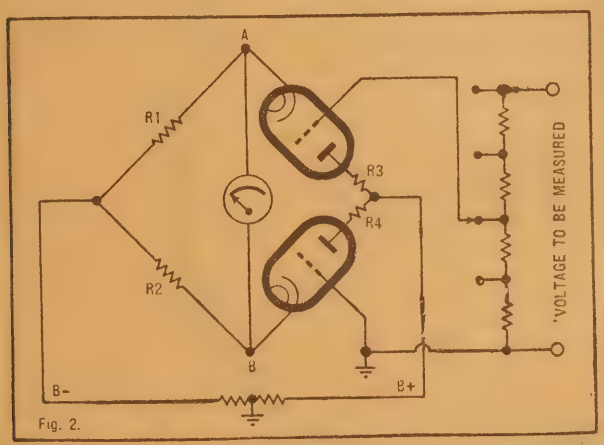


Fig. 2.

changes in operating voltages and valve characteristics. It also gives the instrument a non-linear characteristic, causing the lower values on the meter scale to be crowded. The self-bias resistor, if high enough, can produce an almost linear characteristic, although only at the expense of sensitivity.

A high bias also minimises another problem, the standing current through the meter. Quite obviously this current, representing the "no signal" condition of the valve, will cause the meter to read part of the way up the scale before any voltage is applied, thus reducing the effective scale length. Therefore, the higher the bias the greater the scale length available for actual readings.

When measuring DC with such a circuit the positive side of the voltage is applied to the grid, thus causing an increase in plate current. When AC is applied the valve will function as a rectifier, the positve halves of the valve causing an increase in current but the negative halves having little effect, since the valve is already operating near cut-off.

One objection to this circuit is that it is earthed on the negative side. This means that voltages which are negative with respect to the chassis of a receiver, i.e., some bias and most AVC circuits, are difficult to read unless precautions are taken to ensure that one of the chasses is "floating." This can be a very serious inconvenience and, in most cases, this characteristic is sufficient to render an instrument unsuitable for general service work.

OPERATING POSITION

A method of overcoming the problem is to bias the valve less negatively so that it operates about the centre of its characterisic curve and will change its current value approximately equally for both positive and negative voltages. The sensitivity of the meter is then adjusted so that the standing current causes half-scale deflection. Thus the centre of the scale becomes zero with positive voltages indicated to the right and negative to the left. Such circuits are normally unsuitable for measuring AC unless a separate rectifier is employed.

As you can see there are quite a number of limitations to the simple circuits and although there are other modifications which assist in one way or another the final design usually involves a number of compromises.

For this reason more complex circuits, using balanced bridge arrangements, have become more popular in recent years and these eliminate many of the undesirable features of the simpler types. Further, since components such as power transformer, rectifier, meter, &c., are common to both, the cost of the better type is not so very much greater than the simpler ones. This is particularly so if you are able to make your own.

BASIC IDEA

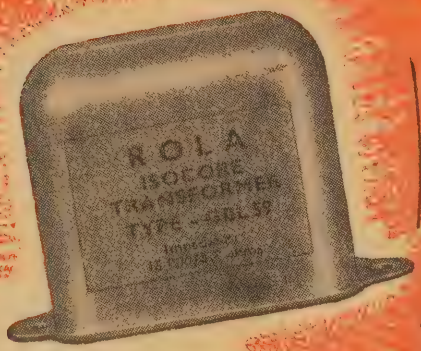
The basic principle underlying these types can best be understood by reference to Figure 2, which is a much simplified circuit showing only the essential features. Naturally there are many variations and refinements from one design to another but the basic principle is the same.

The circuit is essentially a Wheatstone bridge, identical in principle with the bridge we discussed last month, except that part of two of the arms are valves. When the resistance across these valves and their associated resistors (R3 and R4) is equal and R1 and R2 are also equal the bridge will be balanced and no voltage will appear between points A and B. Thus there will be no current flow through the meter and we come to our first advantage, ie, no standing current.

When a positive voltage is applied to one of the grids the balance of the bridge is upset, voltage will appear between A and B, and the meter, if suitably calibrated, will read the amount of voltage.

Because of the balanced arrangement the general stability of the whole circuit is better and variations due to line voltage fluctuations are largely cancelled.

Midget Transformers?



Rola type G Isocore Transformer. Use GCG72 with 6M5, 7,000 ohms load; GDB 63 with 6V6, 5,500 ohms load; GDB60 with KT61, 6,000 ohms load and GDG68 with 6V6, 5,000 ohms load.

For nearly twenty years, Rola Isocore Transformers have been accepted by radio receiver manufacturers and other loudspeaker users as the ultimate in trouble-free transformers, units which were unlikely to break down under even the most rugged operating conditions.

Now, to extend the application of the Isocore Transformer principle to midget A.C. receivers, Rola has developed a new range of G type units.

Measuring only 1-19/32" high by 1-1/8" wide, these new transformers are intended for use with Model SC speakers and are specially recommended for tropical or excessively damp climates.

Four types, suitable for both modern and old type valves, are available.

For full particulars write the Rola distributor in your State for a copy of Technical Bulletin No. 10.

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Because standing current is no longer a problem it is possible to adjust the valve operating conditions so that they function over the essentially straight portion of the characteristic curve, producing a linear scale even on the lowest voltage ranges. Thus the meter need have only a single arc marked in suitable basic ranges which may be multiplied by any suitable factor, such as 10 or 100, if it is required to provide additional ranges.

The question of one side of the input being earthed is no longer a problem, since it is a simple matter to arrange for either grid to be earthed while the other one is connected to the input terminal. Thus the meter can be made forward reading by selecting the correct grid depending on whether the voltage is positive or negative with respect to chassis. Usually a simple two-position switch effects the necessary changeover.

AC READINGS

The circuit as it stands will not measure AC and it is necessary to fit some form of rectifier. While this may take various forms it is desirable that it have as near a linear characteristic as possible in order that the AC scales as well as the DC be linear and, in fact, interchangeable. The ordinary diode valves, such as the 6H6, exhibit this characteristic with reasonable accuracy, providing the voltage is above a certain minimum, and thus are a popular choice in this position.

As with any AC meter the question often arises as to whether it is reading peak, RMS, of mean values. Most VTVMs, including the bridge type, are sensitive to peak voltages but are calibrated in RMS for convenience. This relationship only holds good while the test waveform is sinusoidal, but as this requirement is not hard to fulfil it is normally quite a satisfactory arrangement.

While it is possible to make instruments which are RMS sensitive the circuitry is more complex and the scale non-linear, so that the advantages are doubtful. This is the more so when it is considered that there is no guarantee that any one particular characteristic of the three will be any more valuable than the others. While in certain specialised applications there may be a preference for one or the other this is not normally the case in service work and so the simpler circuits are more popular.

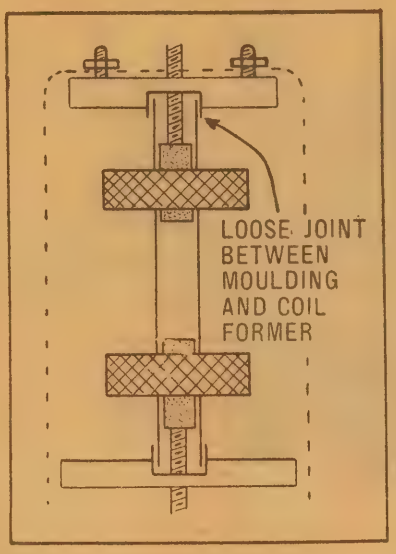
RANGES

At least as many ranges as are available on a standard multimeter should be provided, while a low voltage range is useful in measuring audio voltages and the like, which are often only a fraction of a volt.

At the other end of the scale a top range of 500 or so is probably satisfactory in most cases, although 1000 would be better. With an eye to the future and television requirements it is desirable that this can be increased to several thousand volts Separate external multipliers appear to be the best way of achieving this

As well as serving as a voltmeter, the circuit can also make a very effective ohmmeter, the higher sensitivity making possible ohms ranges which could only be achieved in standard instruments by using inconveniently high voltages. With the VTVM, however, resistance of the order of 100 megohms can be measured with only a few torch cells as a source of voltage.

TROUBLE IN I.F.T.



Showing how faulty mechanical construction in an IF transformer caused alignment difficulties. The loose mounting at the top allowed the winding to move in relation to its tuning slug causing considerable variation in performance.

Many commercial designs finish things off by including standard current ranges in such an instrument, making it a complete AC-DC multimeter little different in its operation from standard type, but having a higher sensitivity than could be obtained even with a very expensive microampmeter movement. The current ranges do not normally employ the VTVM section, added sensitivity here being no great advantage and standard shunting techniques are used.

Well then, should you buy or build your VTVM?

There are some excellent commercial units on the market, some of complete multimeters, which will almost replace the standard multimeter, except for portable work. Less elaborate models have only volt and ohm ranges, but often use a probe to extend the frequency coverage into the RF spectrum.

Depending on the type you want, you can expect to pay between £30 and £40 (or a lot more if you are keen on a de-luxe version), but you will have a good quality instrument, accurately calibrated and carrying the maker's guarantee

HOME CONSTRUCTION

On the other hand, those who do not feel disposed to invest this amount and who have the time to spare should be able to construct their own without encountering any serious trouble.

The Editor is reproducing a typical circuit with this article and, as you can see, there is not a great deal of complexity in it. The finished job will have to be calibrated, but, if use is made of the correct meter scale this is not difficult. The regular multimeter provides a suitable standard, since this is already regarded as having sufficient accuracy for service work.

Since a considerable saving can be effected by "rolling your own," most servicemen will probably take this approach and it would seem to be justified unless your time is so valuable that it cannot be spared for projects of this kind. In the latter case, of course, your business will be so prosperous that you won't miss the price of a ready-made job.

And that, I think, is a pretty fair picture of the VTVM as it applies to the serviceman. Now for some case histories.

Two faults which came my way this month were both of a mechanical nature and, as this appears to be an aspect of the set which is sometimes overlooked by both the serviceman and the maker, their description may serve as a timely reminder. The first concerned an expensive late model radiogram, which the owner claimed, worked perfectly except for the dial mechanism.

TUNING SHIFTED

It seemed that it refused to remain on calibration and also had the habit of jamming, particularly when first switched on of a morning. Rotation of the knob was then stiff and the pointer refused to move.

In this case I decioded that it would be more convenient at least to investigate the job in the customer's home, since it would probably be a simple one and hardly justify the transport of the set to the shop.

My first impression was that the dial drum was slipping on the shaft, although I was temporarily at a loss to explain the early morning jamming of the pointer However, a check on the drum revealed that the bush was secured with two substantial machine screws and was not likely to shift for anything short of an explosion. Mechanically, this part of the dial was excellent.

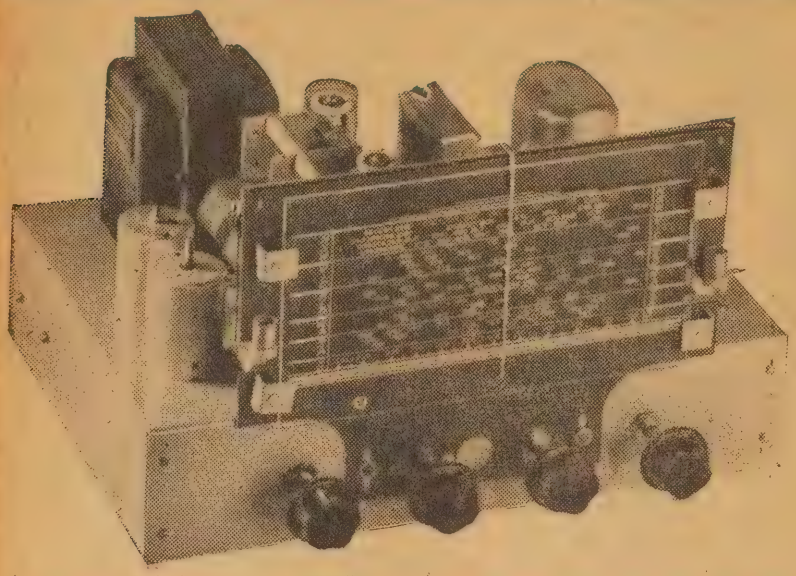
I next considered the possibility of the drum not being properly secured to the bush and moved the mechanism over the full extent of its travel several times, but without result. A more careful check confirmed that this part of the mechanism was also well made and certainly not likely to shift with ordinary use.

CLOSER INSPECTION

I was able to make these observations without removing the set from the cabinet, and I now turned my attention to the front of the dial and was surprised to find that the calibrations had shifted appreciably while I had been checking the drum from the rear. Since the remainder of the dial was not readily accessible I decided the time had come to remove the chassis from the cabinet.

When this was done and the dial operated a few times the fault was plainly apparent. Where the dial cord was attached to the pointer carriage it passed through a small hole in a metal plate which had been twisted at right angles to help secure the cord, the job being finished off with a dab of lacquer. This had worked loose and was allowing the cord—and the remainder of the tuning mechanism—to move while the pointer remained stationary. Hence the shifting calibrations.

(Continued on Page 111)



A front view of the set on a standard R & H chassis design. From the left, the controls are—Tone, Tuning, Function Switch, Volume. The dial size and shape can be selected according to individual taste.

THE '1952 JUNIOR RADIOGRAM'

Just imagine! A full, console, superhet radiogram with only three valves and a rectifier. It tunes all the stations with volume to spare, has more than enough gain for a crystal pickup on any kind of record. It behaves and sounds like a big set. Yes, we're really keen about it—We tip it will start a fashion! Get in now, build your own and save money.

by Raymond Howe

TO the average person, the term "radiogram" means something arge and costly. Often enough, this s true, with the models in the higher-price bracket providing almost everything which "opens and shuts."

But it isn't necessary to go to this extent to get the facility of a radiogram into the home.

With the aid of modern high-gain valves and some design juggling, we are now able to present a set having all of the basic requirements of a radiogram, but which can be constructed for a minimum of outlay. As a matter of fact, the chassis is about as cheap to construct as a mantel set.

DESIGN WINNER

We attacked this problem in the same way as we have approached others in past years by assuming that "there must be an easier way." We believe that we have come up with a design which will be as much a winner as was the Little General in its own class.

This set will tune all the locals with ease at full speaker strength and the stronger interstate stations into the bargain. It is as selective as any other standard superheterodyne and as smooth to handle.

On "gramo" it will play any record you have—or are likely to have—with plenty of reserve gain and the full power of a 4-watt output tube. In this respect it behaves exactly like any of the commercial radiograms on the market which, however, need five valves to do the job.

Like these sets, also, the Junior Radiogram assumes the use of a crystal pickup, because of their high output and their naturally rising bass response. The pickup can be any one of the current models, with interchangeable heads, interchangeably styli or "turnover" heads, as fitted to most record changers.

On purely 78 rpm equipment, the set can be used with high output magnetic pickups, notably the lightweight types with compensated output transformers. However, we are not making a big point of this, because the present trend is definitely toward microgroove discs and equipment.

The Junior Radiogram has a "microgroove" position on the selector switch which provides just about the right amount of treble de-emphasis independently of its regular tone control.

ACCESSORIES

The necessary accessories to such a set are a three-speed turn-table with crystal pick-up of the twin-head or interchangeable head type. These are fairly easy to obtain at the moment, although recent import restrictions may modify that situation somewhat. The price is not beyond the reach of the average person.

The speaker outlook also has brightened up considerably of late, and you should be able to obtain a standard 12in job as fitted to commercial radiograms.

High fidelity components have their place, but not in a simplified radiogram. The price for high fidelity is an expensive output transformer, speaker system, pickup and motor and more complicated electronic design.

These things are all very well if you can afford them and can pick your way through complex circuits. Where circumstances dictate a more modest approach, however, you won't go far wrong with this new set.

It performs well on the air, it sounds well on "gramo" and you'll never be in the position of having to apologise—"of course it's only a small set."

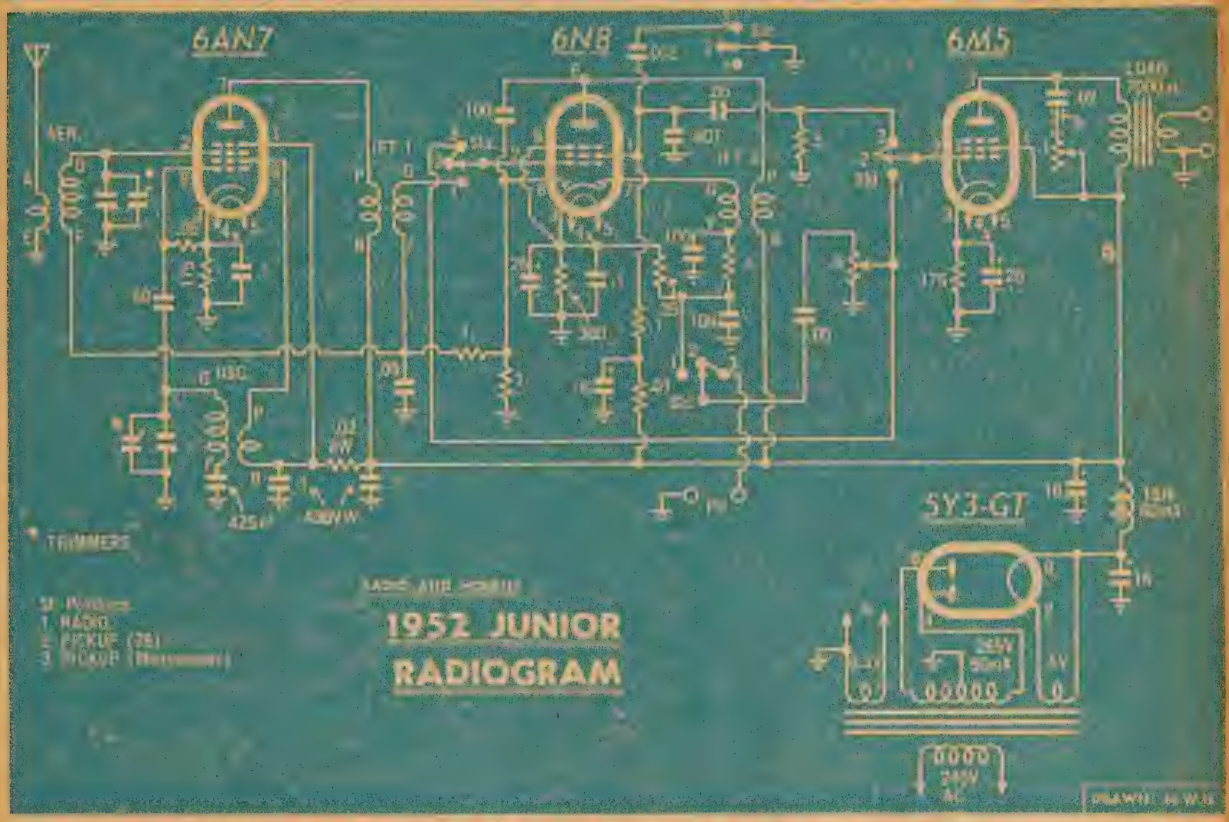
Probably the most awkward accessory item to arrange is the cabinet. This has always been the proverbial "fly in the ointment," with any home-constructed set, mainly from the point of view of cost. Obviously, to get a nicely finished product there is no way out of it, but to pay up and smile—exactly as you would for any other nicely finished piece of furniture.

In many cases, the problem has been solved in the same way as for the set—by home construction. There are limiting factors here such as suitable tools and experience, but, in the main, an acceptable effort can be made.

Another angle is to buy a rough finish radiogram cabinet and do the polishing yourself. Alternatively, with a little ingenuity, one can often suitably modify an existing cabinet to take the set, speaker and turntable, or, if necessary, to fit the

A NEW, SIMPLIFIED MICROGROOVE

CIRCUIT GIVES HIGH GAIN WITH FOUR VALVES



Here is the circuit diagram. Simple though it is, it has good performance as well as versatility. The .05 mfd capacitors can be 200VW except for the coupling from the 6N8 screen where the rating should be 400VW.

turntable into a separate decorative box.

Now to deal with the set itself. For radio reception, the circuitry follows closely along the lines of the popular 1951 Little General, and, for performance with simplicity, it is difficult to beat.

CONVERTER STAGE

The first stage carries the miniature 6AN7, a high-gain converter valve. Electrically, the X61M and the ECH35 are in the same category, but not physically. As we wanted to use the 6M5 output valve for reason of its low drive requirement, it was logical to use the miniature valves in the other two sockets, even though the "GT" series carries types capable of the same performance.

The hexode screen grid and the oscillator plate are fed through a common dropping resistor. While keeping the number of components down, it also provides a certain amount of regulation for the screen voltage, lending to improved AVC control.

This common dropping resistor is shown as a .02 megohm 2 watt. If you cannot get a 2-watt size, you can use two .04 megohm 1-watt resistors connecting in parallel.

While dealing with this stage, we could well mention a point raised almost a couple of years ago. All standard oscillator coils are slug-tuned and, in all cases, the necessary oscillator alignment adjustment at the low frequency end of the tuning range can be made with the oscillator coil slug in conjunction with a fixed padder capacitor of appropriate value.

However, one coil manufacturer prefers to set the oscillator coil inductance at the factory, seal the slug and recommend the use of a variable padder capacitor. This approach is intended to overcome possible difficulties when there is a wide discrepancy between the actual and marked values of a fixed padding capacitor. Of course, selecting a low tolerance capacitor would make things a little more definite.

Actually, the tracking accuracy on the broadcast is open to a little leeway for the home constructor because of the amount of space taken up on the dial glass by station call-sign. However, where adequate alignment experience is lacking, the home constructor is best advised to operate on the principle of having either the inductance or the capacitance value in the oscillator tuned circuit fixed so that time-consuming "trial runs" with random values of each can be avoided.

Where appropriate, the recommendation concerning the padding capacitor is marked on the coil can or carton, so we will leave it to you.

The second stage uses a miniature type duo-diode-pentode, the now-familiar 6N8. In a sense, this stage could be called the heart of the set, because it performs four distinct functions, that of IF amplification, audio detection, provision of AVC voltage and pick-up preamplification when required.

As an IF amplifier it gives quite useful stage gain, more than the older types of such valves. As mentioned earlier, the "GT" series provides the 6AR7-GT which can do just as well but, as we want to switch the grid circuit of this stage, the single-ended 6N8 is more convenient to wire.

I.F. VALVE

As an IF amplifier it operates under optimum conditions with normal bias and the usual value of screen dropping resistor. However, the screen is bypassed to chassis for RF only by the .001 mfd capacitor.

The AVC diode anode is driven from the plate through a blocking capacitor. The negative voltage developed across the 1 megohm load resistor is fed through a single decoupling network of a 1 megohm resistor and a .05 mfd capacitor to the "cold" end of the grid circuit of both the converter and IF stages, to control the gain according to the strength of the signal. Under the circumstances, decoupling of one

RADIOGRAM TO BEAT RISING PRICES

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P.A. RANGE 50-8000 cps Output to Voice Coil

Wts	Primary Impedance	Secondary Impedance	Retail Price	Special Application	Code No.
10	5000, 2500 SE	12.5 8, 2.3	83/9		OP-1
10	5000, 2500 SE	5, 2.7	85/2		OP33
10	5500 SE	3.7	88/2		OP-41
10	30,000 20,000, 14,000, 10,000, 7000, 5000, 2500 PP	2.3	79/7	Universal Test Loud Speaker	OP-53
10	5000, 2500 SE	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	88/2		OP-54
10	5000, 2500 SE	15.	85/2		OP-39
10	10,000 PP	15, 8.4, 2.3	88/2	5W Cath Amplifier	OP-85
10	7000 PP	Any ONE of following impedances — 15, 12.5, 8.4, 2.3, 2.	88/2	9W Cath Amplifier	OP-92
15	5000 PP	12.5, 8, 2.3	129/5		OP-2
15	6600 PP	12.5, 8, 2.3	129/5		OP-3
15	10,000 PP	12.5, 8, 2.3	129/5		OP-4
15	10,000, 6600, 5000 PP	12.5, 8, 2.3	129/5		OP-5
15	5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	129/-		OP-55
15	6600 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	129/-		OP-56
15	10,000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	129/-		OP-57
15	10,000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	130/10		OP-58
25	10,000 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	163/9		OP-59
32	10,000 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	208/9		OP-60
60	3800 PP	17.6	203/7		OP-36
60	3800 PP	100, 75, 50, 25, 10, 5, 2	238/9		OP-61

P.A. RANGE 50-8000 cps Output to Line

Wts	Primary Impedance	Secondary Impedance	Retail Price	Special Application	Code No.
10	5000, 2500 SE	500	83/9		OP-1A
10	5000, 2500 SE	500, 250, 125	90/8		OP-44
15	5000 PP	500, 250, 125	129/5		OP-6
15	6600 PP	500, 250, 125	129/5		OP-7
15	1000 PP	500, 250, 125	129/5		OP-8
15	10,000 PP	500, 250, 160, 125, 100, 83.5, 71.5, 62.5, 55.5, 50	137/6		OP-8M
15	10,000, 6600, 5000 PP	500, 250, 125	129/5		OP-9
15	5000 PP	600, 300, 200, 150, 130, 100, 75, 50	140/3		OP-34
15	8000 PP	600, 300, 120, 60, 30	245/-		OP-50
25	5000 PP	500, 250, 125	156/3		OP-10
25	6600 PP	500, 250, 125	156/3		OP-11
25	10,000 PP	500, 250, 125	156/3		OP-12

P.A. RANGE Cont.

Wts	Primary Impedance	Secondary Impedance	Retail Price	Special Application	Code No.
25	10,000, 6600, 5000 PP	500, 250, 125	156/3		OP-13
25	10,000, 6600 PP	500, 4000, 8.4, 2.2	200/10	Cutting and Playback Amplifier	OP-35
25	6600 PP	600, 300, 250, 200, 170, 150, 76, 50, 36, 27, 12.5, 7.5, 3.6, 2.7	245/		OP-38
32	5000 PP	500, 250, 125	189/2		OP-14
32	6600 PP	500, 250, 125	189/2		OP-15
32	6600 PP	500, 250, 166, 125, 100, 83.5, 71.5, 62.5, 55.5, 50	192/3		OP-15M
32	10,000 PP	500, 250, 125	189/2		OP-16
32	10,000, 6600, 5000 PP	500, 250, 125	189/2		OP-17
32	6600 PP	140, 70	209/		OP-48
60	3800 PP	500, 250, 125	206/3		OP-18
60	3800 PP	100, 75, 50, 10, 5, 2	238/9		OP-61
80	6400 PP	500, 250, 125	253/2		OP-37
105	8800, 6000 PP	500	382/6		OP-49
150	11,600, 8400 PP	500, 250, 166, 125	481/8		OP-20

HI-FI RANGE 30—15000cps Output to Voice Coil

Wts	Primary Impedance	Secondary Impedance	Retail Price	Special Application	Code No.
5	5000 SE	Any ONE of the following impedances 15, 12.5, 8.4, 6.5, 2.1	82/6	4W Baby Playmaster	OP-24
10	3250 SE	12.5, 8.4, 2.3	132/1	R & H Vox Major	OP-23
10	5000 SE	2	112/6	For Rola 120x Speaker	OP-113
10	5000 PP	2	112/6	For Rola 120x Speaker	OP-117
10	6600 PP	2	112/6	For Rola 120x Speaker	OP-119
10	8000 PP	2	112/6	For Rola 120x Speaker	OP-118
10	10,000 PP	2	112/6	For Rola 120x Speaker	OP-112
15	5000 PP	12.5, 8, 2.3	192/3		OP-19A
15	10,000 PP	15, 3.75	186/11	10W Playmaster	OP-63
15	10,000 PP	12.5, 3.125	186/11		OP64
15	10,000 PP	8.4, 2.1	186/11		OP-65
20	4500 PP	15.5, 12.5, 8.6, 2.7, 2	164/2	15 & 32W Cathamplifiers	OP-51

Output to line

Wts	Primary Impedance	Secondary Impedance	Retail Price	Special Application	Code No.
10	3250 SE	500, 250, 125	132/1		OP-22
15	5000 PP	500, 250, 125	192/3		OP-19B
15	10,000 PP	500, 125	186/11		OP-62

SPECIAL HI-FI RANGE 20-30000 cps

Wts	Primary Impedance	Secondary Impedance	Retail Price	Special Application	Code No.
15	10,000 PP	8.4, 2.1	192/9	For Williamson Amp.	OP25/8.4
15	10,000 PP	10, 2.5	192/9	For Williamson Amp.	OP25/10
15	10,000 PP	12, 3	192/9	For Williamson Amp.	OP25/12
15	10,000 PP	15, 3.75	192/9	For Williamson Amp.	OP25/15
15	10,000 PP	16, 4	192/9	For Williamson Amp.	OP25/16
15	10,000 PP	40, 10	192/9	For Williamson Amp.	OP25/40
15	10,000 PP	250, 62.5	192/9	For Williamson Amp.	OP25/250
15	10,000 PP	500, 125	192/9	For Williamson Amp.	OP25/500
15	5000 PP	8.4, 2.1	235/-		OP-66
15	5000 PP	15, 3.75	235/-		OP-67

ENGINEERED **TO-DAY** FOR **TO-MORROW'S** REQUIREMENTS

stage from the other was not necessary.

Returning the AVC load resistor to chassis places a "delay" voltage on this diode equal to the bias voltage developed across the cathode bias resistor. This means that the AVC does not come into action until the input signal is above a certain minimum level, thus leaving the full sensitivity of the set available for the tuning of weak stations. This is called "delayed AVC."

The detection diode circuit is standard, the only step beyond the simple basic circuitry being the RF filter network formed by the two 100 pf capacitors and the .1 megohm resistor. The stray capacitances added by the wiring of detection diode load to the selector switch rendered this necessary.

For pick-up use, preamplification is obtained by taking advantage of the amplification factor, which exists between the control grid and the screen grid of the valve. All that is involved is the arrangement of the appropriate switching—fortunately a fairly simple matter.

The gain rendered available by this means is more than adequate for a crystal type pick-up to drive the audio power stage to the overload point, when something between 3 and 4 watts will be delivered to the speaker transformer.

Let's trace the wiring of the selector switch, section by section. In position 1, the grid of the 6N8 is connected to the secondary winding of the first IF transformer, the detector diode load is connected to the volume control and the grid of the 6M5 is connected to the moving arm of this control. This is the "radio" position of the switch and gives you any programme you care to tune in.

P.U. POSITION

In position 2, the "radio" circuitry is broken and the grid of the 6N8 is connected to the moving arm of the volume control, while the control is simultaneously connected to the pick-up terminals. Thus, signals from the pick-up are fed to the 6N8 grid to be amplified, then taken from the screen circuit to drive the 6M5 audio power valve. This holds for playing standard 78RPM discs.

In position 3, the same circuit arrangement stands, but with an additional .002 mfd bypass at the screen of the 6N8. This gives a fixed amount of treble attenuation to de-emphasise the normal treble "lift" in the recording characteristics of microgroove discs. This value may require some adjustment to trim off any "peaks" in the response characteristic of the pick-up used, and of the speaker system, for that matter.

On the other hand, some may prefer a little treble lift (insufficient de-emphasis bearing in mind that, when it isn't wanted, it can be removed manually with the tone control in the output stage.

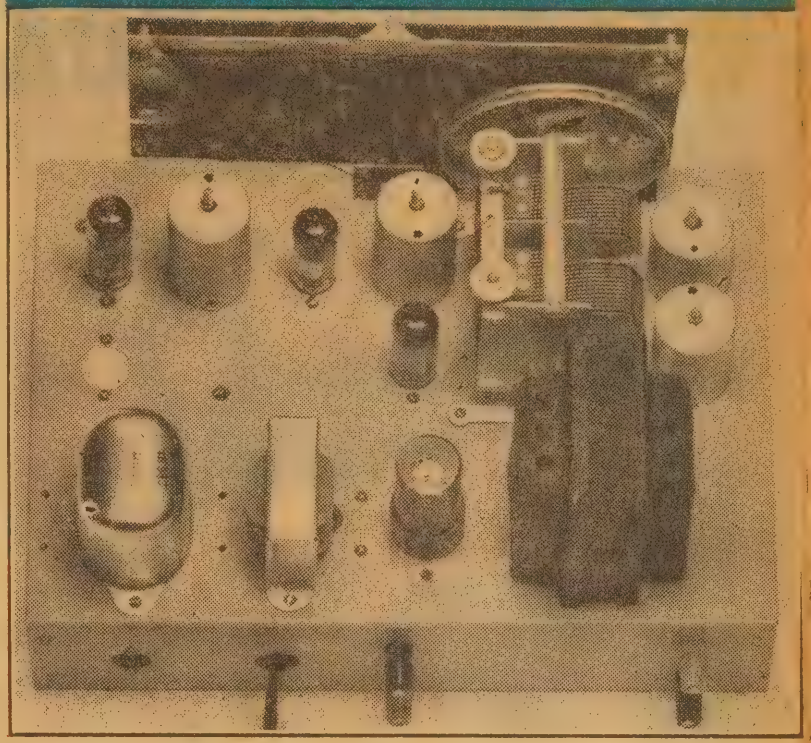
We were tempted to be "smart" at this stage and wire a feedback resistor of about 1 megohm between the plate of the 6M5 and the screen of the 6N8, taking a .1 mfd 400VW capacitor from this screen to position 1 of section "b" of the switch.

In position 1, the feedback would be rendered inoperative by the .1 mfd thus maintaining the audio sensitivity for "radio," while in positions 2 and 3, the feedback would operate to improve the audio characteristics somewhat at the expense of gain.

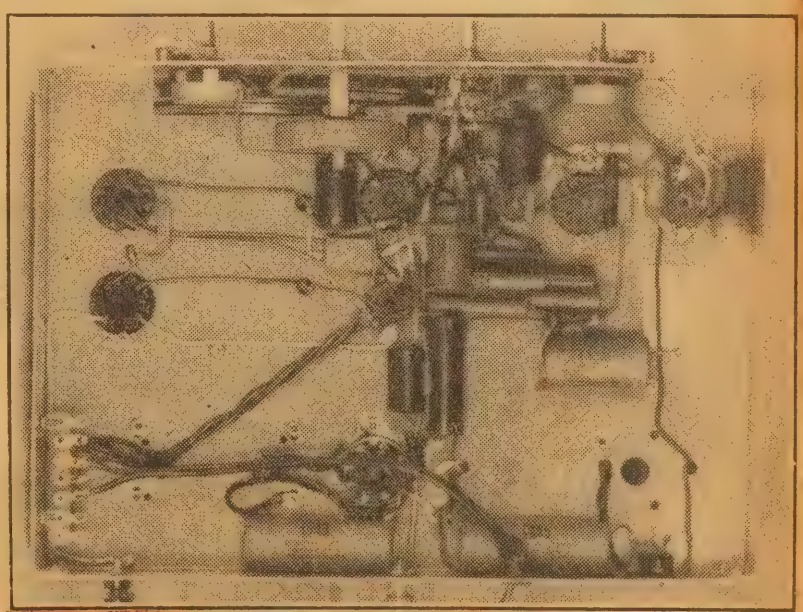
However, our prime object is to keep this set as simple as possible consistent with the desired results. Any such additions can be left to the discretion of the individual.

As previously mentioned, the 6M5 was selected for the power output

SET BUILT ON ADVANCE CHASSIS



At the top left is the 6M5, followed by the IFT2, 6N8, IFT1 with the 6AN7 towards the chassis rear. At the right of the gang are the oscillator and aerial coils in that order from the dial. From the left along the chassis rear are the speaker transformer, filter choke, rectifier and power transformer. The aerial and earth terminals are at the right.



This view shows that standard-sized components can be fitted without undue cramping. There is adequate space around the switch for the associated components. Note the plate over the spare valve hole.

stage because of its comparatively low grid drive requirement, with particular reference to the "radio" position. We have not used any parasitic suppressors in either the grid or screen circuits because, with the speaker transformer mounted directly on the chassis near the valve, we did not find any evidence of it wanting to "take off" on its own.

This stage carries the fourth knob, the tone control. It is the usual simple affair giving treble attenuation, sometimes referred to as "top cut." It is useful for reducing the effect of electrical noise on radio reception and of undue surface noise when using the pick-up on old discs.

POWER OUTPUT

The valve is capable of an output approaching 4 watts. We measured a good 3½ watts into the primary winding of the speaker transformer. Remember that the efficiency of the speaker transformer has the last say in the level reaching the speaker voice coil. In the average case, don't expect much more than 2½ to 3 watts to reach the speaker, but this in a lot of noise in a quiet home. We guess that your average requirement will be nearer a quarter-watt.

You may rightly wonder why we have not used the "triode" function of the 6N8 to give extra gain on radio as well as on "gramo." The answer is simple—this would be a reflex arrangement and dogged with the limitations of a reflex set, notably the "minimum volume" effect.

It would have more gain, to be sure, but you wouldn't like it as much.

You will notice that all three valves are provided with cathode bias. In a standard set it is possible to bias the converter and IF stages with one component, a resistor in the transformer centre-tap and to which the AVC diode load resistor is returned.

Unfortunately in this set, the switching in the 6N8 does not allow us to do this with ease, and, consequently, seven components are taken up simply in biasing the stages. It would be possible to do this, but the added complication in the switching would probably cost more than the components it would eliminate.

The power supply uses a standard transformer type with a 5Y3-GT. This rectifier and its earlier counterpart, the 80, are easy to obtain and because its higher internal impedance tends to keep the HT voltage closer to the desired level, it was selected in preference to the 6X4, 6X5-GT types.

The output voltage from the filter is about 265 volts for the "signal" condition and just under 260 volts for the "no signal" condition. The DC resistance of the filter choke will have a bearing on what actual voltage will appear.

We suggest that you use 16 mfd electrolytics for the filter capacitors, going to 24 mfd, 525PV if you want to be extremely fussy about the residual hum level. As the set stands with the 16 mfd, the hum is as good as and even better in some cases than most of the commercial sets.

While on the matter of hum, you will notice that the screen coltage feed point of the 6N8 is decoupled from the HT line with a .01 meg and an 8 mfd. This is necessary to prevent residual hum on the HT line from being fed to the grid circuit of the 6M5 and amplified on "pick-up."

Constructionally, there was no need to make this a small set. Furthermore, we wanted to use a chassis of another popular set so that the ready-made job would be readily available.

"ADVANCE" CHASSIS

It so happened that the 1951 and 1952 "Advance" chassis suited the desired layout admirably. The extra holes required were only those necessary to change from the higher-quality filter choke and output transformer to the standard choke and speaker transformer. The unused valve hole was simply covered with a plate.

If you have had a little experience in set construction before you should find no difficulty in completing this set in a few evenings.

Our usual practice in describing a set is to briefly run over the points to watch in the construction so that new readers do not have to turn back to or attempt to locate past issues containing such information.

When mounting the coils, IF transformers and valve sockets on the chassis, it is well to remember that the positions which will give the

PARTS LIST

1 chassis 12½" x 9" x 2¾" (1952 Advance)
1 power transformer 285V a side 60mA, 6.3V at 2A, 5V at 2A.
1 60mA filter choke, 15 to 20 henry.
1 2-section tuning gang.
1 dial with glass to suit (USL/32 or similar).
1 aerial coil, 1 oscillator coil, broadcast.
2 standard 455 kc IF transformers, Nos. 1 and 2.
3 miniature 9-pin valve sockets, 1 octal socket.
1 miniature 4-pin plug and socket.
2 gang section trimmers.
1 4-pole, 3-position switch.
1 speaker (pref. 12in) with 7000 ohm transformer.

VALVES

1 6AN7, 1 6N8, 1 6M5, 1 5Y3-GT.

CAPACITORS

2 25 mfd 40PV electrolytics, 2 16 mfd 525PV electros., 1 8 mfd 525PV electro. 2 .1 mfd 400VW, 2 .1 mfd 200VW 1 .05 mfd 400VW, 2 .05 mfd 200VW, 1 .02 mfd tub., 1 .002 mfd tub., 1 .001 mfd tub. or mica, 1 425 pf low tolerance mica, 3 100 pf mica, 1 50 pf mica.

RESISTORS

2 1 meg. 1 w., 1 .5 meg. potentiometer, 1 .5 meg. ½w., 1 .25 meg. ½w., 1 .1 meg. potentiometer, 1 .1 meg. 1w. 1 .1 meg. ½w., 1 .05 meg. ½w., *1 .02 meg. 2 w. (or 2 .04 meg. 1 w. in parallel), 1 .01 meg. ½ or 1w., 1 300 ohm ½w., 1 175 ohm ½ or 1w., 1 175 ohm 1w.

SUNDRIES

4 knobs, 4 terminals (2 red, 2 black) 1 6-tag and 2 2-tag mounting strips. 1 1" threaded mounting pillar, power flex and plug, approx. 2ft shielded wire, dial lamps, scrap aluminium, hook-up wire, nuts. bolts, solder, solder lugs.

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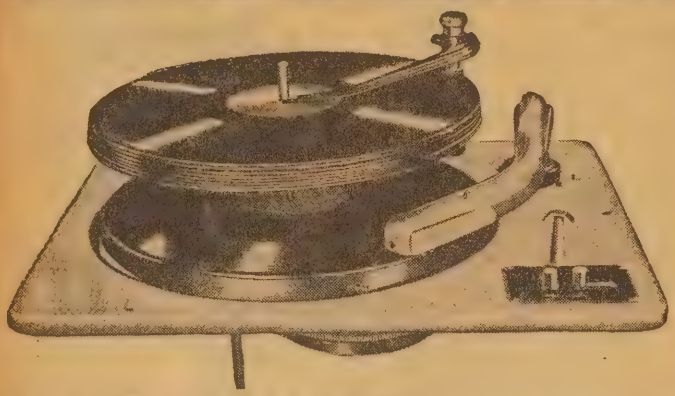

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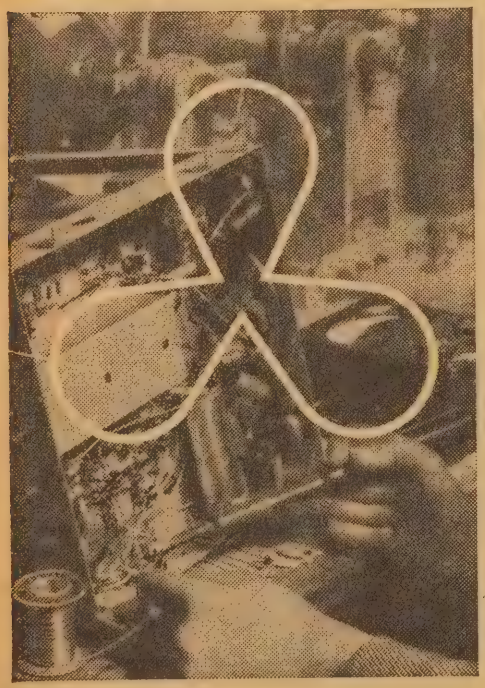

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E1/268

shortest lead length in inter-stage wiring is to be desired.

To this end, we arranged these components in the following positions—the coils with the grid pins toward the gang, the 6AN7 socket with the gap between pins 1 and 7 toward the 6N8 socket, the 6N8 socket with the gap toward the 6AN7 socket, the 6M5 socket with the gap toward the nearest chassis corner, the IFT1 with the plate pin toward the gang, the IFT2 with the plate pin toward the 6N8 socket. The line of the mounting holes of these components is along the short axis of the chassis.

DIAL MOUNTING

It is a good plan to mount the dial before the wiring is commenced so that you will know in which position the flywheel falls. Note that it is necessary to "float" the dial drum on the gang spindle and, in so doing, take a firm grip of it to avoid letting the cord drive come adrift.

Mount solder lugs under each socket bolt and under each of the front securing nuts of the IF transformers. There are one or two other lugs required at odd positions but you will soon find the most suitable place for these. Connect all lugs together with a run of light-gauge tinned copper wire.

Don't forget to "earth" the centre spigot of each valve socket, otherwise you will most certainly encounter instability. Another "must" is the "earthing" of one side of the heater circuit. This can be done at any one of the valve sockets.

Give a little thought to the lay of the components around the switch before actually commencing the wiring of it.

Use for the switching of the 6N8 grid circuit that section which will give shortest leads to the IFT1. Then work around in a clockwise direction, when looking on the lugs, in the order as lettered on the diagram. Everything will more or less fall into place.

P.U. WIRING

Insulate both pickup terminals from the chassis, connect the inner conductor and shield braid to them and take it across to the switch, keeping the braid from making contact with the chassis until it nears the 6N8 socket or reaches the switch. This can be achieved by an aerial run or by slipping spaghetti sleeving over the braid.

To wire the tone control, connect the .02 mfd capacitor from the plate pin to the blank pin 9 and from there to the .1 meg potentiometer through shielded wire earthing the shield braid at any convenient point. The other side of the potentiometer connects to any convenient point on the high-tension line.

Finally, connect the trimmers to the top of each gang section where they are most convenient. Check over your wiring and clear out all loose blobs of solder. Plug in all valves except the rectifier and switch on. See that the valves light up and then gently slip the rectifier into its socket, watching for any internal blue glow which would indicate a short-circuit beyond the rectifier output.

See that the dial pointer has equal overlap at each end of its travel, connect an aerial and earth and

(Continued on Page 112)

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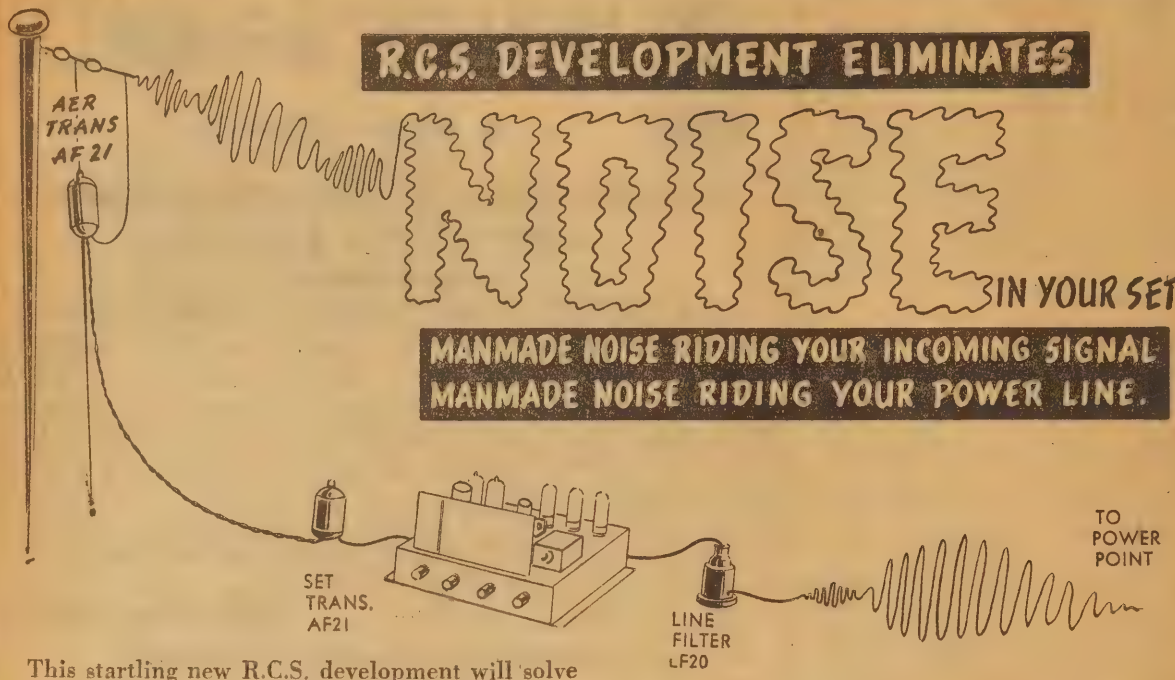

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KNOW YOUR ELECTRICAL UNITS

EVEN though we tried to avoid it, the terms, "volt," "ampere," "resistance," &c., appeared several times in the description of the buzzer and motors. Perhaps you already have a good idea of their significance or perhaps you know nothing about them but, in either case, it is best to be sure.

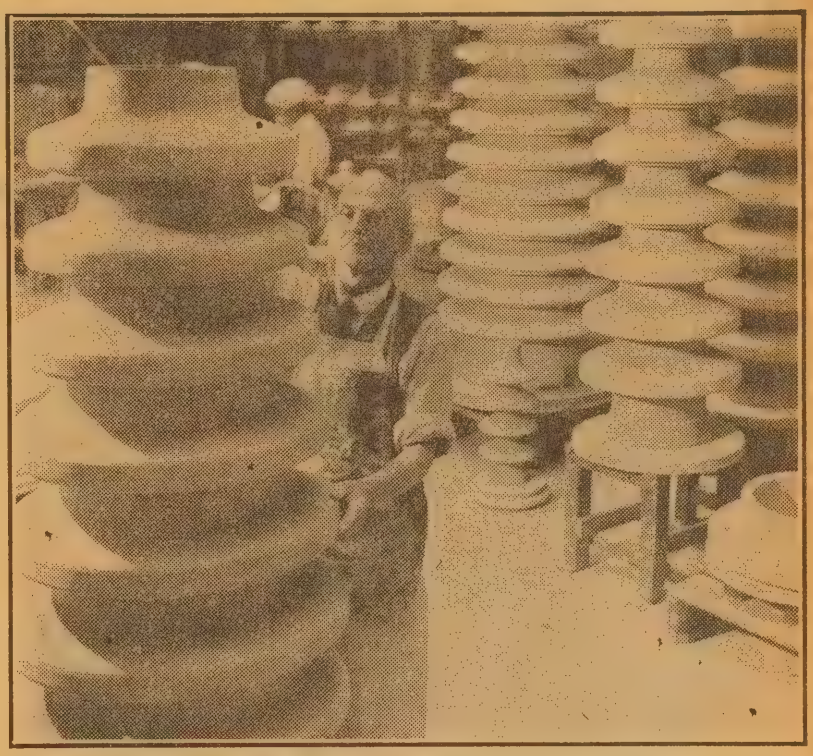
The units we have mentioned are used to measure electricity. You are very familiar with some of the units used to measure other quantities.

If somebody asked you how big a certain book is, you could simply say "big," "medium-sized," or "small," according to your judgment but that may or may not convey a very exact impression of the book to the enquirer. Your idea of big or small may be quite different from his.

EXACT SIZE

But if you say the book is, by way of example, 10in by 8in by 2in thick, the other person will have an exact knowledge of the size of the book. If he wants to make a cover for the book he could very likely go away and do so, guided by the dimensions, even though he has never even seen the book.

This is possible because there is an exact system of units for measuring length which is known all over the world. The length of the standard is not so important as the fact that there is a standard in existence. The standard from which all other units of length are derived in British countries is the yard. It is actually a piece of metal kept in London.



When voltages become high enough even the air of the atmosphere will break down and become a conductor. Besides providing good insulation these high voltage insulators have circular fins to extend the length of the air path.

Up to date, we have deliberately avoided anything that smacks of mathematics in the "Junior Experimenter" series. Our main aim has been to show you, in the most interesting way possible, what electricity is and what it can do. However, this is very much like the house built on the sandy foundation as mentioned in the proverb.

Another important standard measurement of length is the metre. The standard metre is kept near Paris. It is slightly longer than the yard but the fact that it can be used as a basis for comparing lengths is the important point.

In electricity, too, we have a system of standards by which comparisons can be made and this system is just as important to the electrician as the rule is to the carpenter or engineer for measuring length.

MORE ABSTRACT

Electrical measurements are a little more difficult to understand than simple measurement of length but, if you have carried out the experiments we have described in the earlier articles, you should have no difficulty in understanding them.

As you know, electricity is a flow of electrons in a metal wire or other conducting material. You also know that for a certain battery different amounts of electrons can be made to flow according to the resistance of the circuit.

For instance, if you connect a short length of thick wire to a car battery, as in the experiment to determine the magnetic field around a wire, there will be a brilliant flash as the circuit is opened and closed indicating that a very heavy current is flowing.

Leave the wire in contact with both terminals of the battery for more than a few seconds and the wire will melt because of the heat generated by the current.

On the other hand, if you connect a very long length of this wire (more than you are likely to want to waste for the experiment) or better still a small electric lamp of a voltage rating matching the battery, the flash as the circuit is made or broken will not be so noticeable.

This quality of "resistance" to the flow of electric current can be measured very precisely. The unit of resistance is the "ohm." It is named after a German scientist, George Simon Ohm, who stated an important relationship between electrical quantities during the last century. We will come to this relationship, known as Ohm's law, later.

A short length of thick wire has a low resistance. For example a length of 10 gauge copper wire (1-10in diameter approximately) 1ft long has a resistance of only 1-1000 of an ohm. Copper wire 1-100in diameter and 1ft long has a resistance of about 1-10 of an ohm. Copper is an excellent conductor of electricity bettered only by silver. Most metals are good conductors of electricity.

Materials such as wood, paper, ebonite and glass are very poor conductors, that is, they have a high resistance.

A piece of glass 1-10in diameter and 1ft long has a resistance of many millions of ohms. The value is so high that the current that would flow through it were a battery connected between its ends would not be worth considering.

"RESISTANCE"

Other substances, such as carbon and certain metals have resistances midway between that of copper and glass. These are useful if we wish to adjust the amount of electric current flowing in a circuit.

The resistance between your right and left hand is in the order of 50,000 ohms. You can measure the value if you have a radio ohm meter. Note that the tighter you hold the test prods the better contact you will

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make and the less the resistance will be. The human body then is neither a very good or a very poor conductor of electricity.

A standard value of resistance for comparison purposes can be made very accurately in a laboratory but you are not likely to want to do this. If you want a resistor of a certain value you can walk into a shop and buy it. True, you rely on the reputation of the manufacturer for its accuracy but, for many applications in radio and electrical work, resistors may vary as much as plus or minus 10 pc without the results being very serious. Usually the tolerance is stated.

During the discussion about resistance we had something to say about current. For the same reason as it is necessary to have a standard by which to compare resistances it is necessary to have a standard by which to compare the volume of electricity flowing in a circuit in a certain time. The unit of current is called the "ampere" after a French physicist.

THE AMPERE

Like the unit of resistance it is capable of very exact definitions in terms of other physical quantities, but you can buy meters already calibrated by the manufacturer which will read current within certain given tolerances. Except for very special purposes the current scales included in ordinary radio multimeters are quite accurate enough.

In order to give you an indication of how big the ampere is we will quote some examples. When you switch on a small electric torch there is a current of about ½ ampere flowing. The spark which results from making the circuit is quite small. To see it clearly you would need to be in a darkened room. On the other hand, when the short length of wire is connected to the car battery a current of many hundreds of amperes flows and there is no doubt about the spark.

By the way, please don't go around shorting car batteries with thick pieces of wire. It is very bad practice and we use the case only by way of illustration.

There is a third electrical unit which we must introduce now. This is the unit of electrical pressure called the volt which, like the others, is named after a scientist.

In order to make electric current flow in a wire there must be a driving force just the same as there must be a driving force to make a current of water flow in a pipe. Talking about so many volts in electricity is like talking about so many pounds per square inch pressure when dealing with the flow of water.

WATER ANALOGY

As a matter of fact it is possible to build up a very effective analogy using the idea of flowing water, to help you to visualise what happens when current flows in a wire. We used this idea in explaining a problem to "Tom" in the March issue. If you haven't managed to get a good grasp of the idea you will find the article on page 40, last month.

In the same way as water pipes have to be thick to withstand high water pressure, electric wires have to be well insulated to withstand high electric pressure or voltage. Have you ever noticed the long insulators used in high-tension power circuits? These are necessary to withstand the high voltage without allowing any of the current to flow away and be wasted and also perhaps cause damage. The voltage at which power distribution mains operate may be many thousands.

Ordinary household electric power circuits have a pressure of 240 volts. This is still quite a dangerous pressure but it is capable of being insulated by much more moderate means than the long porcelain insulators of the power circuits. The cords leading to vacuum cleaners, toasters, &c., can be rendered safe by a layer of plastic, cotton or rubber.

Car batteries usually provide either 6 or 12 volts. You can touch the terminals, one with each hand, without receiving an electric shock. Torch batteries have a lower voltage still, 4.5 or 3 volts being common figures.

Given an electrical circuit of a certain resistance, the higher the voltage, the more current will flow. Alternatively, if you have a certain voltage the lower the resistance the more current will flow.

You can easily see that the three electrical quantities, pressure, current and resistance are very closely connected. If, in a particular circuit, you change the value of one of these, one or both of the others will also change automatically.

BRITISH IMPERIAL STANDARDS

The standards on which all British measurements are based are kept by the Board of Trade in London. Special conditions of temperature &c. under which they are to be used are imposed and they are never touched except with special tools for the purpose. The standard pound is of platinum while the standard yard is of bronze.

Make certain that you understand the connection between the three units, because it is very important to all electrical calculations.

We have just expressed the general idea in words. This is all very well but, if you wish to calculate the voltage of the battery you require to make a certain amount of current flow in a circuit of a particular resistance, you will need some more exact means of arriving at the figure.

CONNECTION BETWEEN UNITS

From the physical definitions of the units we are told that if a pressure of one volt is applied across the terminals of a resistor of one ohm, a current of one ampere will flow. Increase the pressure to two volts and two amperes will flow. With three volts the current will be three amperes and so on.

If we retain the original one volt supply and increase the resistance to two ohms, the current will only be a half ampere. However, if, with the two ohm resistor we increase the voltage to two, the current will again be one ampere.

The figures are not always so simple as this and, with more difficult figures, it is easier to use symbols for the electrical quantities and make the calculations with the aid of symbols.

By way of convention the symbol E is used for voltage, I for current and R for resistance. Since current increases when voltage increases and decreases when resistance increases, we can express the idea by saying:

$$I = \frac{E}{R}$$

If we know both E and R we can substitute figures for the letters and find the current. Say for instance we

ANSWER TO PROBLEMS

(From next page)

1. 12.5 ohms	6. .5 amperes
2. 4 ohms.	7. 324 volts
3. .33 amperes	8. .099 amperes
4. 12 amperes	9. 18 ohms
5. 33.3 ohms	10. 2400 ohms

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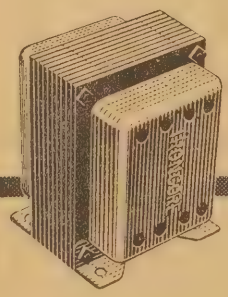
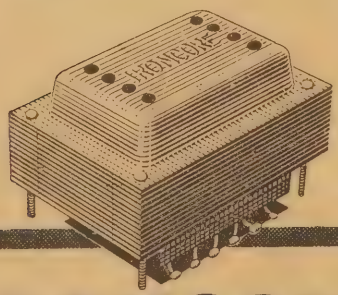
(3) All coils are precision-layer-wound from the highest grade wire. Gauges to full specification.

(4) All coils are impregnated in a special high melting-point wax, as a permanent safeguard against moisture.

(5) Liberal core area of scientifically designed laminations gives minimum iron losses; maximum tolerance of burr .003 of an inch.





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connect a 45-volt battery across a 15 ohm resistor. We have:

$$I = \frac{45}{15} = 3 \text{ amperes}$$

This is because 15 divides into 45 three times.

Knowing the applied voltage and resistance of any particular circuit you can use the formula to calculate the current.

Knowing the applied voltage and the current flowing you can calculate the resistance of the circuit. If you wish to keep a certain constant current flowing and increase the applied voltage you must increase the resistance. Or, if you keep the voltage constant and vary the current you will need to decrease the resistance to increase the current.

The two ideas can be expressed together symbolically by saying:

$$R = \frac{E}{I}$$

It is possible that you will have to deal with a circuit where you know both the resistance and the current, but wish to calculate the applied voltage.

Taking the same line of reasoning as before, if for a given resistance the current flowing through it is increased the voltage developed across it will increase. However, if you want to keep the current constant and increase the resistance you must also increase the voltage. Treating these two ideas together in the same way as before we get the result.

$$E = I \times R$$

Knowing the three forms of the formula we can calculate any one of the three quantities knowing the other two.

There is a simple little device which will make it easy for you to remember the three forms.

Write down:

$$\frac{E}{I \times R}$$

Now, put your finger over the unknown quantity and the formula for calculating it will be what is left. If you can remember this little device you have mastered the three formulae.

It is this relationship between resistance, voltage and current in an electric circuit that Ohm first explained, so it is now known as Ohm's Law.

One important point to be watched when using the formulae is that all three quantities must be expressed in the basic units of volts, amperes and ohms.

If you happen to have the current expressed in milliamperes (1/1000 part of an ampere) it is necessary to convert to amperes before using the formula. In this case simply divide the figure in milliamperes by 1000. For example, 250 milliamperes equals 250/1000, which equals ¼ amperes.

Radio calculations involve current expressed in milliamperes more frequently than amperes since many of the circuits involve high values of resistance. Frequently, too, resistance values are expressed in terms of megohms (millions of ohms). Instead of saying 500,000 ohms it is easier to say .5 megohm.

The problems we have set are quite simple once you have the idea, but they will help you to remember the different forms of Ohm's Law and to use it with confidence whenever the need arises. Make certain that you use the correct formula, since some of the questions appear easier to calculate with the wrong one.

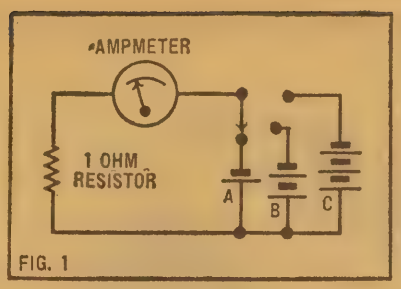


FIG. 1

Fig. 1. A, B and C are respectively 1, 2 and 3 volt batteries. As the switch is rotated to connect them into circuit the ampmeter will read, in turn, 1, 2 and 3 amperes. This demonstrates that the current increases directly as the voltage.

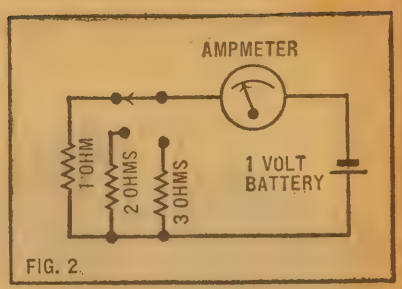


FIG. 2.

Fig 2. As the 1, 2 and 3 ohm resistors are switched into circuit, in turn, the current will be 1, ½ and 1/3 amperes showing that the current decreases as the resistance increases. The formula I equals E/R is a combination of the results of Fig. 1 and Fig 2.

TEST YOURSELF WITH THESE PROBLEMS

Using which of the three forms of the Ohm's Law formula apply, work out the unknown quantity in the following problems. For example, in question 1. we have to find the resistance in a particular circuit when with a 25 volt supply there is a current of 2 amperes flowing. From the formula:

$$R = \frac{E}{I}$$

We get:

$$R = \frac{25}{2} = 12{\cdot}5 \text{ ohms}$$

Now try the rest of the problems. The answers appear on page 67.

	E (volts)	I (amperes)	R (ohms)
1.	25	2	—
2.	16	4	—
3.	150	—	450
4.	6	—	0·5
5.	100	3	—
6.	23	—	46
7.	—	36	9
8.	11	—	121
9.	9	0·5	—
10.	240	0·1	—

ANOTHER EXAMPLE

By way of another practical example, say that a 15,000 ohm bleed resistor is to be connected from the high tension supply of a receiver to earth. The high tension voltage is 250. It is required to calculate the current flowing so that it can be judged whether the supply can safely take the extra drain.

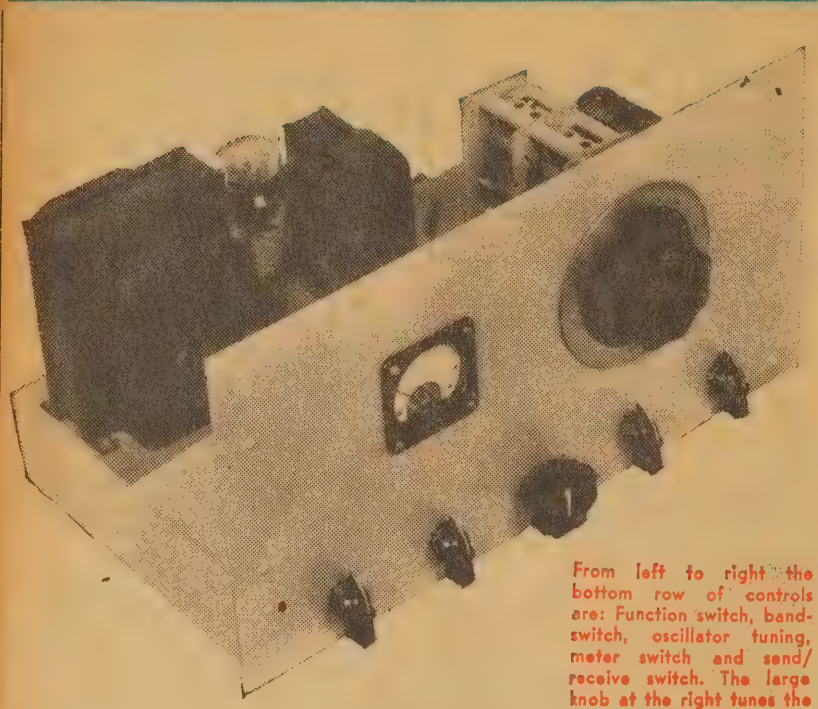
Having determined that the current is 16.6 mA, the designer can add this to the current drain of the receiver to make sure that the total is within the ratings of the power transformer, rectifier valve and filter choke.

This brings us back to the point on which we began the discussion. You will realise how important it is that there is a standard system of units. Without the system the transformer manufacturer woud have no way of telling the receiver designer how much current his transformer is capable of delivering with safety.

DERIVED UNITS

The amazing part about it is that, although they may appear to have no connection, all these units can be arrived at with absolute precision from the standard units of length, mass and time. It is quite a long story to show how this is done, but you can read it in some of the standard textbooks of physics or your science teacher may be able to explain it to you.

The next topic to be brought forward in the Junior Experimenter series is that of electric cells. Up to date we have depended on ready made sources of power, but it is fascinating to try manufacturing your own. There are several types of batteries you can make at home with odds and ends. Besides being instructive it is very good fun.



From left to right the bottom row of controls are: Function switch, bandswitch, oscillator tuning, meter switch and send/receive switch. The large knob at the right tunes the PA.

SIMPLE 4-BAND TRANSMITTER

A new style in transmitters is set by the brand new 17 watt job, full constructional details of which are given in these pages. The RF unit is completely self-contained, requiring only an aerial and power mains to go on the air. Bandchanging over the four popular amateur bands is simplified by a neat switching system. All this, and it uses no special transmitter components.

by Maurice Findlay

IT is some years since we described a transmitter for the popular amateur bands. In that time there have been plenty of changes in the outlook of amateur radio to influence the design of new equipment.

After the war, there were hundreds of amateurs, many of whom had received their training in the Services, anxious to get on the air. Sometimes the cost was secondary. There was plenty of deferred pay and tempting disposals equipment was plentiful.

DISPOSALS PARTS

New amateurs were often able to go straight on the air with the full licensed power of 100 watts with the aid of a few disposals, transformers, filter chokes, capacitors and high-powered transmitting valves. In many cases it cost very little more to use the full power than something more modest.

However, we can no longer count on such equipment. The large majority of it has already been distributed and the newcomer has to depend on components available through the normal trade channels.

As a matter of personal interest, we checked through a catalogue and added up the prices of the new major components for a 100-watt phone transmitter. Neglecting small components and assuming that the chassis would be home-made, the figure was still rather staggering.

This makes a very strong case indeed for a transmitter making use of receiver-type valves, power-transformers, filter chokes and capacitors, assuming that reasonable power output can be obtained. After all, it is no use making a transmitter so low-powered that it will be hopelessly lost under other signals in the crowded amateur bands.

After considering all the factors involved, we found that it is possible to design a simple transmitter for an input of up to 17 watts and still not use any special components. Even the final tuning capacitor of our finished job is a broadcast receiver 2-gang.

With the usual qualifications as to bands, conditions and antennas, 17 watts is sufficient to put worthwhile signals into any part of the world.

Having decided the power and general style of the components to be used, we were able to plan the physical form of the finished transmitter.

CHASSIS DIMENSIONS

Standard rack and panel arrangements employ 17in chassis and 19in panels. This seemed much too large for our purpose, particularly as it is possible to build the RF section, complete with power supply, in considerably less space. Accordingly, we decided on 15½in panels with 14in chassis. We intend to adopt this as a standard for equipment requiring something smaller than the usual 19in standard from now on.

Until now, the most popular valve for medium power transmitters has been the 807. However, this is no longer available at a special price, and, in keeping with the general trend toward economy, it is necessary to choose a valve available at a more moderate price.

In view of its power sensitivity, the the familiar 6V6-GT beam power tetrode is an excellent choice. The new miniature type 6BW6 which has characteristics almost identical with the 6V6-GT is even better for the job, because of its reduced lead inductance. Unless you already have some 6V6-GT's on hand we suggest that you use the 6BW6 in the new transmitter.

Alternatively, the Philips "Innoval" 6M5 will do much the same job, requiring only a slight change to the socket wiring.

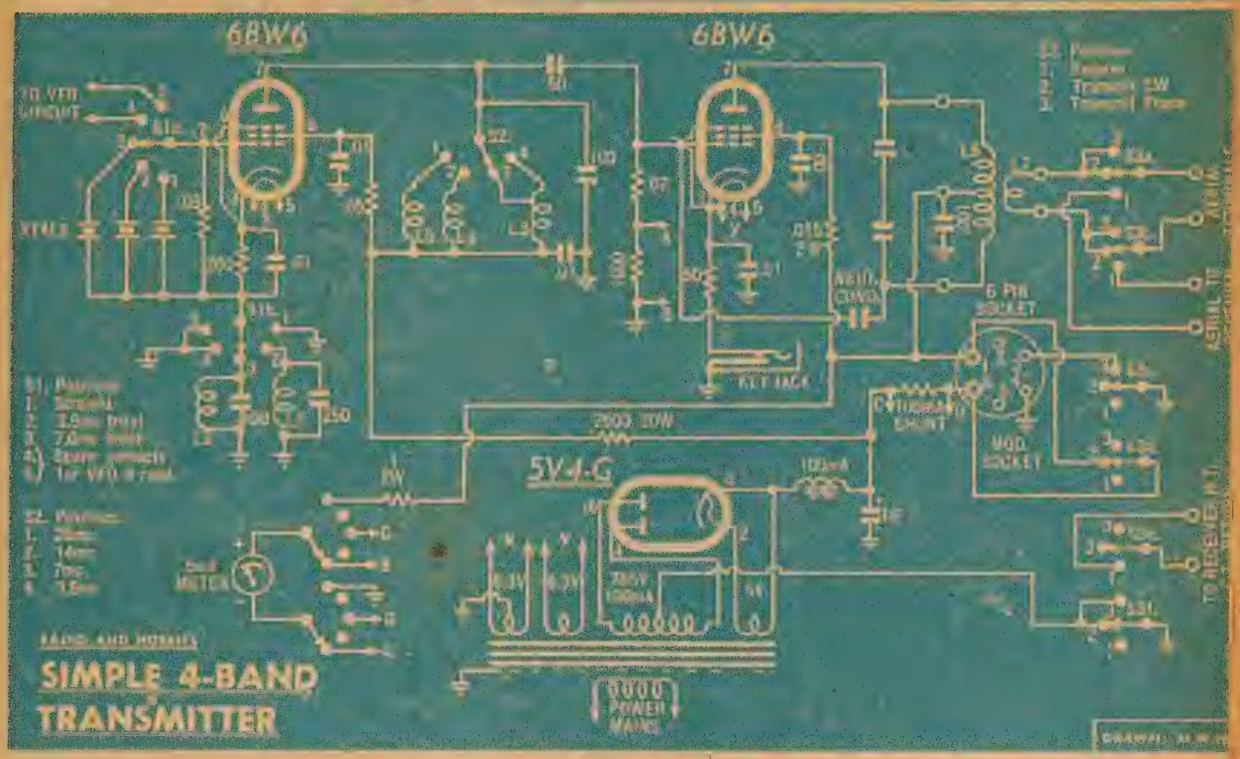
As a class C amplifier either the 6V6 or 6BW6 may be operated with 350 volts on the plate and loaded up to approximately 50 mA so that the power input to the plate is 17.5 watts.

Possibly the only disadvantage of the 6V6-GT and the 6BW6 types is that they require neutralisation, at least, on the two higher frequency bands under consideration. Even the 807 exhibits a certain amount of coupling between the plate and grid at higher frequencies and there is worthwhile argument for neutralisation where perfect modulation is desired.

Having decided on the power amplifier, it remains to provide suitable excitation for it on the four amateur bands under consideration, namely 3.5 Mc, 7 Mc, 14 Mc and 28 Mc.

Crystals for both 3.5 and 7 Mc

FIRST UNIT OF A COMPLETE AMATEUR STATION



Although the switching tends to make the circuit appear complicated it is basically conventional. Possible later provisions are a key click filter and provisions for varying the screen resistor of the oscillator valve to suit various crystals.

are plentiful but, in this country at least, 14 and 28 Mc crystals are almost unkonwn. In order to obtain output on the 28 Mc band it is necessary to multiply the output of a 7 Mc crystal four times.

Experience has shown that, from an active 7 Mc crystal in a "tritet" circuit, it is possible to obtain about 3.5 mA drive on 28 Mc giving a convenient margin over the minimum of 3 mA. Only the one valve is required. Using a 7 Mc crystal there is a reserve of drive when doubling to 14 Mc or operating it as a straight oscillator giving output on 7 Mc.

PLENTY OF DRIVE

A 3.5 Mc crystal used in the tritet circuit will provide about 4 mA drive when quadrupling to 14 Mc while allowing a reserve of drive both when doubling to 7 Mc and when used as a straight oscillator on 3.5 Mc.

With a 3.5 Mc crystal it is not possible to obtain sufficient output from the oscillator on 28 Mc to drive the PA while keeping within the safe ratings for crystal current and valve power dissipation. Since most amateurs will have 7 Mc crystals available an extra stage to permit 28 Mc operation from a 3,5 Mc crystal is not normally warranted.

All coil changing for the crystal oscillator stage is taken care of by two switches. S1b allows the oscillator to be switched to any one of three separate functions.

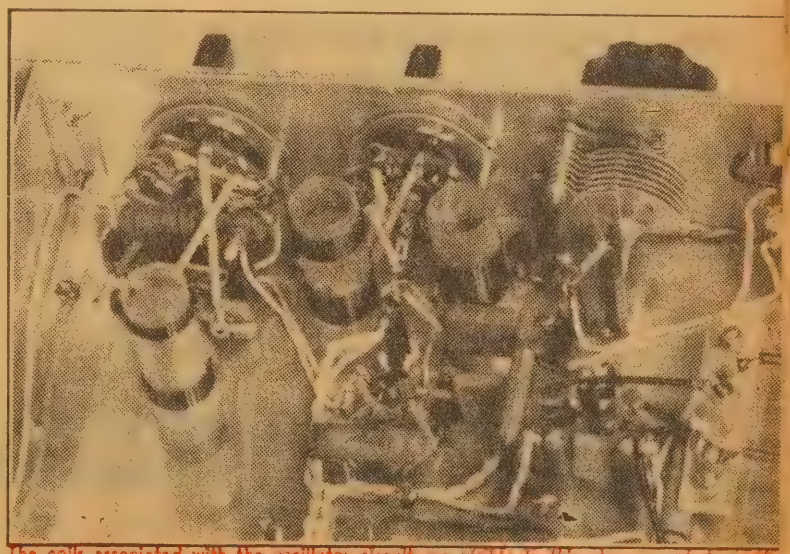
In positions 1, 4 and 5 the cathode circuit is returned direct to earth, under which condition the valve will oscillate at the fundamental frequency of the crystal in the grid circuit, provided the plate circuit is tuned to resonance.

The cathode circuit will be required to be earthed also when the output of a VF0 is fed into the grid.

In positions 2 and 3, tuned circuits, which allow the valve to operate as a harmonic oscillator with 3.5 and 7 Mc crystals respectively, are introduced. Data for the coils is given in the coil table.

Sometimes small mica capitors ar considerably off their marked valu so that it may be necessary to var the coils by as much as one tur either way in order to obtain opt mum output.

S1a and S1b operate together sinc S1 is a standard single wafer 2-po 5-position switch. S1a allows ar one of three crystals to be selecte or, if desired, excitation may be ob tained from an external VFO.



The coils associated with the oscillator circuit are visible in this close up photograph. All are wound on ¾in diam formers. The neutralising capacitor is mounted on the block of polystyrene at the right.

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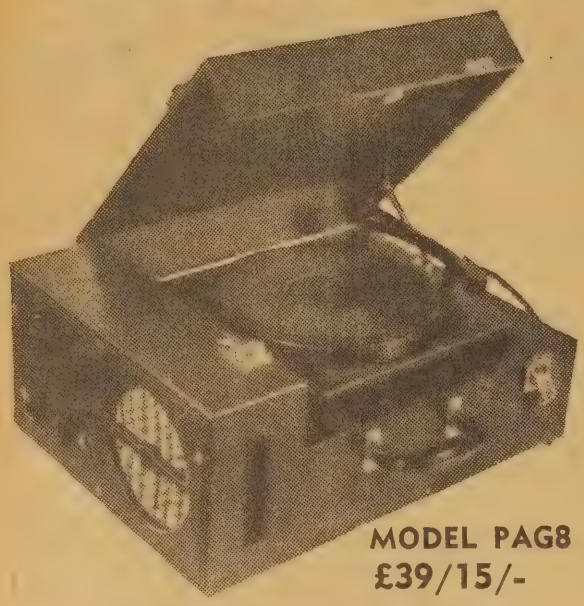

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The arrangement of the crystal sockets is largely a matter of personal choice as many will have crystals requiring different types of holders for which they will wish to provide. In this case, two or more crystal holders may be connected in parallel to the required switch position. Alternatively, two or more switch positions may be bridged and connected to two or more crystal holders in parallel.

USING A VFO

It is difficult to give exact data on connecting the VFO into circuit since the requirements vary greatly. In many cases the output from the VFO will be on 3.5 Mc but others are likely to require provision for 7 Mc VFO's. If the VFO has a low impedance output, a broadly-tuned step up transformer would probably be necessary to make the drive voltage high enough. This is one of the matters we will discuss in a later article on setting up the transmitter as part of a complete station.

The frequency of the plate circuit of the oscillator is selected by S2. On all bands except 3.5 Mc, resonance is reached with the tuning capacitor near minimum capacitance. A single tapped coil is used for the 3.5 Mc and 7 Mc ranges.

The activity of crystals is subject to wide variation and some will find that the drive available on the lower frequency bands is far in excess of requirements. As S2 will normally be a 2 pole 5 position switch the second pole may be used to switch a higher value of resistance into the oscillator screen circuit if necessary.

Ordinary wafer switches are not able to handle the current and RF voltages built up in the PA circuit and, there being no special switches available, we decided to use a plug-in coil arrangement for the final tank circuit. The plastic coil formers we have used in a number of previous circuits are no longer in good supply and it is necessary to manufacture something to replace them.

In our case the raw materials in the form of banana plugs and sockets came from an ex-service coil unit but the necassary parts are available from the regular supply houses. The sockets are mounted on a block of polystyrene 2in x 3in which is in turn mounted on ebonite pillars to bring it up to the level of the tuning capacitor.

COIL MOUNTING

The banana plugs are mounted on blocks of polystyrene 2¾in x 1¼in. Three plugs are needed for L6 and two for L7. We found it convenient to mount them in two rows ½in apart with the plugs spaced 1in in the rows. The plugs for L7 are mounted between those for L6 in the other row so that the 5 plugs provide a firm support for the coil.

In order to provide out-of-phase voltage for neutralisation purposes, the final tank circuit is of the balanced variety using a tapped coil. The tuning capacitor is a stanard 2-gang the sections of which are effectively connected in series.

Much less capacitance is required to neutralise the 6BW6 than is the case with the usual triode transmitting valves and rather than use a special neutralising capacitor, we manufactured one from some pieces of scrap brass which are mounted on a block of polystyrene. Neutralisation was achieved with two pieces of brass 5/8in x ¼in mounted 1/16in apart. It will be necessary to adjust the neutralisation exactly before the transmitter is operated but this can be done simply by bending the plates.

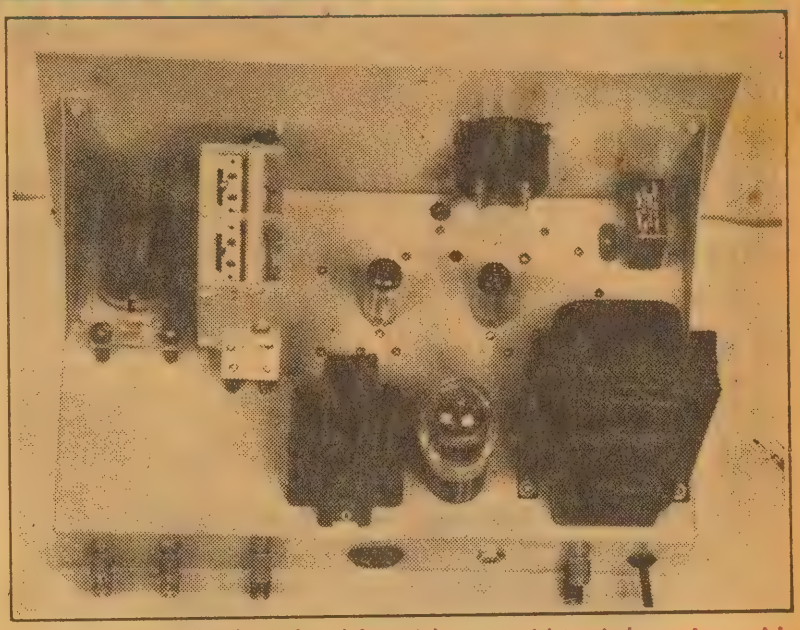
A two-bank three-pole three-position switch carries out all the operations necessary to change from "send" to "receive."

S3a and S3b switch both sides of a balanced line to the transmitter output link or the receiver aerial terminals. If you decide to use an unbalanced system, such as a coaxial line only one section of the switch will be required. S3e is used to break the high tension supply of the receiver in the "transmit" position.

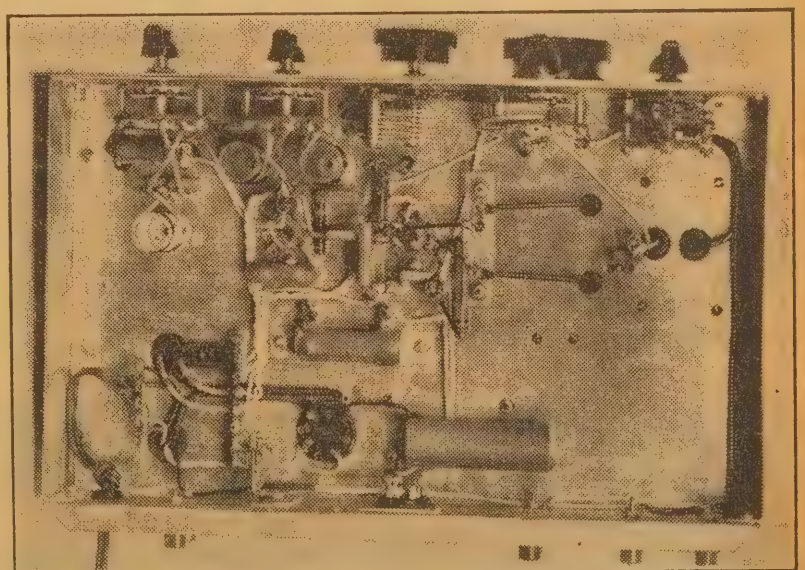
S3c and S3d take care of the modulator. The modulation transformer is shortcircuited in position 2 by S3d and S3e earths. the centre tap of the modulator power transformer in the phone position.

In order to change from a position of phone transmission to "receive" it is necessary to pass through the "CW" position. The purpose of this is to prevent and possibility of feedback through the modulator as, due to the charge in the filter capacitors,

REAR AND UNDERNEATH VIEWS



Along the back of the chassis from left to right are: aerial terminals, receiver aerial terminals, receiver control terminals, modulator socket, key jack, VFO terminals and power cord. Note that the tuning capacitor frame is insulated from ground. It is operated via an insulated coupling.



There is plenty of room for all components underneath the chassis. The send/receive switch (top right hand corner) should be wired before it is installed.

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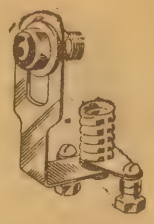

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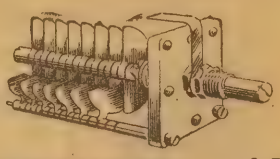

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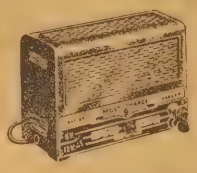

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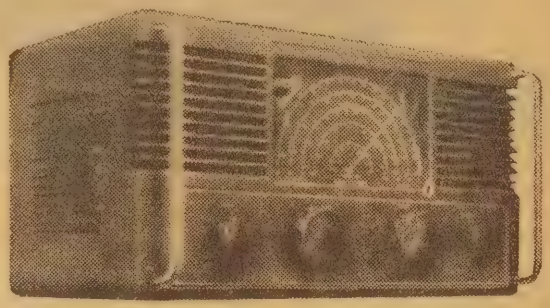

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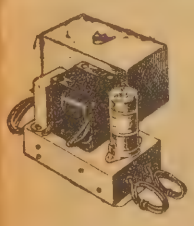

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the transmitter is operative for a fraction of a second after the circuit is broken.

With certain receivers, feedback will take place when changing from the "transmit CW" position to "receive." If this is troublesome, it may be desirable to short the screen of the crystal oscillator to earth in "receive" position. There is a spare lug on S3f which can be used for this purpose. We would suggest a resistor of 1000 ohms or so to limit the peak current through the switch. We will check this point with a number of receivers with a view to discussing it further next month.

Provision is made for metering the high tension voltage, and the plate and grid current of the PA.

You can provide for checking the plate current of the oscillator if you wish but this is hardly necessary, since it is limited to a safe value by the high tension dropping and bias resistors.

The 1000 ohm shunt resistor in the grid circuit is so large in relation to the resistance of the meter that its shunting effects may be neglected.

The 100 mA shunt is adjusted by trial and error, comparison being made with another meter. In our case, the final shunt consisted of 40 turns of 28 gauge wire bound on a 1 watt resistor. It would be wise to start with a greater number of turns and gradually reduce the number until the correct value is obtained.

In designing the transmitter considerable thought was given to the matter of the power supply which, in addition to supplying 350 volts at the required 80 mA, must have good voltage regulation for big changes in current drain.

KEYING CIRCUIT

The most straightforward and generally acceptable method of keying the transmitter is to insert a key in the cathode circuit of the PA so that he key breaks the high tension supply of the final stage. However, a change from key up to key down conditions involves a change of over 50 mA in the high tension current. This, in turn, causes the voltage applied to the oscillator stage to vary, the amount of the variation depending on the regulation capabilities of the power supply.

The most serious result of this is likely to be a slight change in frequency with keying which is heard as a "chirp" on the air and which makes the signal difficult to read.

In the case of the simple two-stage transmitter described in the October 1948 issue we used a separate power supply for the oscillator. However, in this case we only require 350 volts for the PA. It is possible to obtain almost this figure from a standard 385 volt power transformer and at the same time realise the advantages of a choke input filter system if low impedance rectifier is used. The most suitable valve which is readily available is the 5V4-G.

With the power supply shown the keying characteristics are excellent without resort to any special voltage regulator tubes. Reports from other amateurs on the air indicate that it delivers a T9 note with no tendency to chirp.

After the assembly and wiring have been completed, the first job is to check the operation of the crystal oscillator. Switch S2 to 3.5

(Continued on Page 112)

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Input V	Output V	MA	£
12	250	80	2.10.0
12	300	250	4.10.0
12	500	160	8.10.0
or 6			
24	250	60	1.15.0
24	300	250	2.10.0
24	230	100	2.10.0
24	1000	350	4.10.0
24	550	375	4.10.0
32	275	60	2. 0.0
32	275	100	3.10.0

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3.8 to 5.8 megs

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Crystal controlled. Air tested. Including crystal. **£30/-/-**

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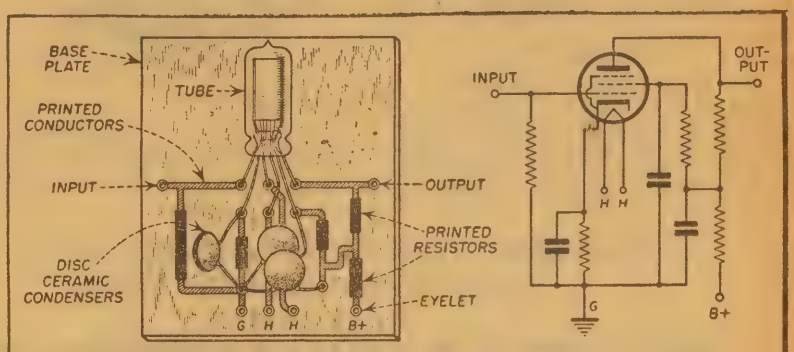
PRINTED ELECTRONIC CIRCUITS

The reproduction of electrical circuits on insulated surfaces by various printing techniques has become a standard method of fabricating small, lightweight, economical electronic devices. The increased emphasis placed by the armed forces and industry on miniaturisation and ruggedness of electrical components has caused this innovation to assume vital importance.

PRINTED circuitry is no longer confined to a few military devices and hearing aids, but may now be encountered in a large number of everyday equipments. These include speech amplifiers, portable receivers, citizens' two-way radios, television receiver front-ends, FM receivers and many others.

For this reason, a working knowledge of the design, production and maintenance of such circuits will be a valuable asset to any worker in the electronics field. This article is concerned with a discussion of the general types of printed circuits, the relative advantages of each and methods of effecting servicing repairs.



TYPICAL PRINTED CIRCUIT AND DIAGRAM

FIG. 1

SIMPLIFIES PRODUCTION

The use of printed circuitry has been revolutionary, not only because it permits the fabrication of extremely small and rugged electronic components, but also because it reduces the production of such components to a simple, rapid operation which is almost completely devoid of the possibility of human error.

By this method, a relatively unskilled operator can reproduce literally hundreds of complex units in the time formerly required to make one unit by old-fashioned "wire-by-wire" soldering techniques.

In addition to electrical conductors, critical circuit components such as resistors, capacitors and inductors can be "printed" into the circuit in the same operation and held to close, reproducable tolerances. Fig. 1 shows a typical printed circuit and its schematic diagram.

Printed circuits are classified according to the method used to produce them. There are, at present, six general types. These processes are: Painting, spraying, vacuum evaporation, chemical processing, metal stamping and powdered metal dusting. Each of these general categories will now be discussed in some detail.

PAINTED CIRCUITS

Probably the most widely-used process for producing printed circuits is the *painting* technique. In this method, the conductors and other components of the circuit being fabricated are painted on the insulating surface which acts as the base for the circuit.

The paint may be applied by hand with a brush, although in production operations the silk-screen stencilling process is more frequently used. Thin ceramic or plastic sheets may be employed for the base, or a metallic surface covered with an insulating lacquer may be used.

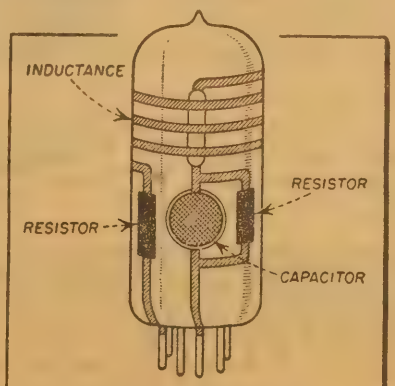
In special instances, the glass envelope of a vacuum tube has been utilised as a base for its associated printed circuit. See Fig. 2.

The paint used for electrical conductors consists of a powdered metal such as copper or silver in suspension in a liquid binder. This conducting paint is applied to the surface of the insulating base to form the "wires" of the circuit.

Other paint, made up of a resistive material such as carbon, may be applied in specific amounts to form resistors. Capacitors may be made by printing the plates on opposite sides of the base plate, if the required capacitance is small. Otherwise, small capacitors are connected to the printed circuit, as in Fig. 3.

It is interesting to note that these capacitors are manufactured by processes which are essentially printed circuit techniques. Inductances are produced by painting spirals of conducting paint on the surface of the ceramic or other base material.

"Cross-overs" in the wiring are made by painting one conductor directly over the other, with a layer of insulating material, such as lacquer between, or by "detouring" one conductor to the other side of the plate for a short distance by means of metal rivets or eyelets through the insulator, as is illustrated in Fig. 4.



PRINTED CIRCUIT ON TUBE ENVELOPE

FIG. 2

When all printed components have been painted in place, the entire assembly is "fired" at an elevated temperature to fuse the metal particles together and bond the circuit to the base plate. Temperatures ranging from room temperature for plastic bases to as high as 800 degrees C. for ceramics are used.

Vacuum tubes, external leads and other components not printed are soldered to eyelets in the base plate, as in Figs. 1 and 3. To take maximum advantage of the space-saving properties of printed circuits, tubes of the subminiature type are usually employed.

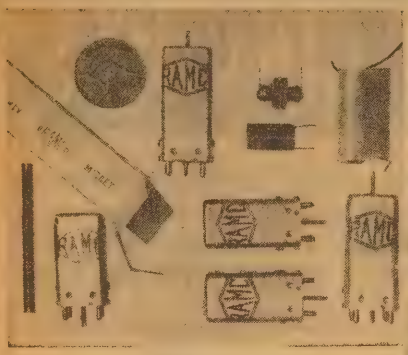
The painting technique has the advantage of requiring a minimum of auxiliary equipment and so has been the most popular type for experimentation and design work with printed circuits. It is also the best method to use in making repairs on printed circuits, as will be discussed later.

SPRAY TECHNIQUE

The spraying method of reproducing printed circuits differs from the painting technique in that the conductors are sprayed onto the surface of the base. Both molten metals and metallic conducting paints may be applied in this manner.

In some processes stencils are used to define the circuit conductors. In others grooves are machined or moulded in the base material where a conductor or other circuit component is desired. Grooves may also be formed by sand-blasting through a stencil. Metal is then sprayed over the entire base plate, filling the grooves and covering the spaces between. The surface is then milled off, removing the excess metal and leaving only that in the grooves.

High conductivity is obtained by



BRAMCO
Car Radio Coil Kit

Coil kit for broadcast-band car radio, complete with several associated circuit components. Illustration, shown with a penny for comparison, indicates compactness of units.

BRAMCO
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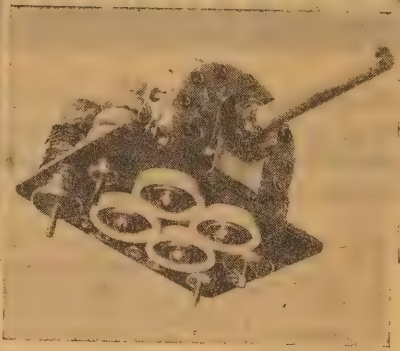

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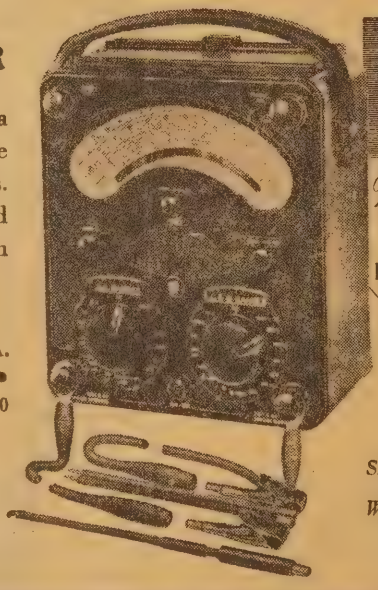
Recently developed, the Model "8" Avometer has a sensitivity of 20,000 ohms per volt on the D.C. voltage ranges, and 1,000 ohms per volt on the A.C. ranges. Range selection is mainly by means of two switches, and a movement reversing switch is fitted to facilitate certain D.C. tests.



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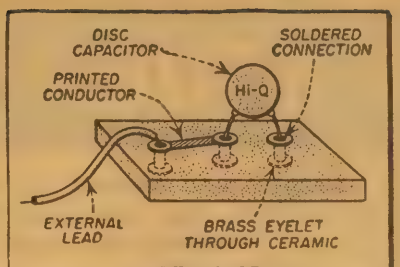
this method since relatively large conductors are formed in the grooves. Standard tube sockets and other components are sometimes connected to sprayed circuits by mounting them on the opposite sides of the base plate so that the terminals protrude through holes into the grooves. Then when the circuit is sprayed connections are automatically made to the conductors.

Circuit crossovers are made in a manner similar to that employed in the painting process. Resistors, capacitors and inductances may also be formed by spraying.

The vacuum evaporation process of circuit printing consists of evaporating a metal such as silver, copper or nickel onto the surface of the dielectric material by melting the metal in a vacuum. A mask or stencil on the surface of the insulator is used to outline the circuit desired.

In one such process, called "cathode sputtering," a high voltage is applied between the source of metal vapor (the cathode) and the work upon which it is to be deposited (the anode). The metal vapor is thus drawn to the work by electrostatic forces. Only a "rough" vacuum, such as can be produced by a good mechanical vacuum pump, is required for this process.

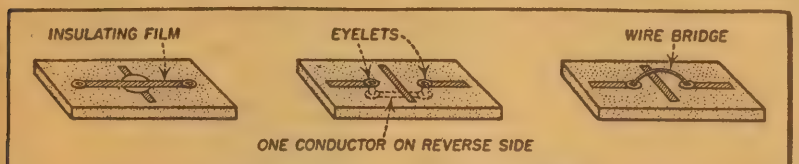


METHOD OF CONNECTING WIRE LEADS
FIG. 3

may be backed by an adhesive to insure a good bond. Circuits made in this manner have good conductivity.

The last general type of printed circuit is produced by a process known as "dusting." In this method, a powdered metal is dusted on to the insulating base plate and fired in place.

The circuit outline is defined either by coating the entire insulator with a sticky substance and applying the metal powder through a stencil, or by applying the bonding substance through the stencil and then dusting on the powder so that it is held in place by the adhesive until fired.



TYPES OF CONDUCTOR "CROSS-OVERS"
FIG. 4

Another vacuum process used is very similar to cathode sputtering except that no voltage is applied between the cathode and the work. Metal evaporated from a heated filament or other source of metal vapor is distilled on the printed circuit plate placed over it. In either type of vacuum processing it is unnecessary to further heat-treat or fire the deposited metal.

Only thin films are usually deposited in this manner. If greater conductivity is required conductors may be built up by electroplating.

In the chemical-deposition methods of making printed circuits the techniques employed are similar to those used in silvering mirrors. A silvering solution consisting of ammonia and silver nitrate mixed with a reducing agent is poured on the chemically-clean surface to be coated. The confines of the solution are controlled by an adhesive stencil.

PLATING

The metal films obtained are usually too thin to permit direct soldering but may be built by repeated coatings or by plating. The chemical processes have not been applied as extensively as those discussed above.

The metal stamping technique has been used principally to print loop antennas on the back covers of radio receivers. However, other types of circuit wiring have been produced by this method. A die bearing the outline of the desired circuit is used to press a thin metal foil into the surface of a plastic or other insulator.

In the same operation the sharp edges of the die cut the metal sheet to the desired shape. The metal sheet

As was mentioned above, the most convenient method of making repairs and replacements in printed circuits is the brush-applied painting technique. Kits of such paints, including both conductor and resistor mixtures, are commercially available.

Most of these paints require no heat for drying, so that they may be used for repairing circuits having parts which cannot be subjected to high temperatures. This is an important precaution when working with circuits printed on certain types of plastic.

Although subminiature tube sockets are sometimes used with printed circuits, tubes are frequently connected directly to metal eyelets in the base plate, as in Fig. 1. When replacing tubes connected in this manner, care must be exercised to avoid the use of excessive heat during soldering operations.

Soldered connections may also be made directly to printed conductors if the base material will stand the heat involved. A solder containing a small percentage of silver should be used for best results.

Where soldering is inadvisable connections to tube leads and other wires should be made with metallic paint.

CIRCUIT REPAIRS

Printed resistors which have become defective may be repaired or replaced by the painting technique. Defective resistors are located in the usual manner with an ohmmeter.

If it becomes necessary to "disconnect" a printed resistor from the circuit for a resistance check, this may be accomplished by scratching through the printed conductor lead with a sharp instrument. If defective, the resistor may be repaired with resistive paint.

It will usually be found to be open or high in value. In such cases, additional resistive paint should be applied over the old resistor to reduce its resistance to the proper value.

Some commercial printed circuits have a protective layer of lacquer over the conductors and particularly over resistors to prevent moisture absorption. This coating must be completely removed before repairing resistors.

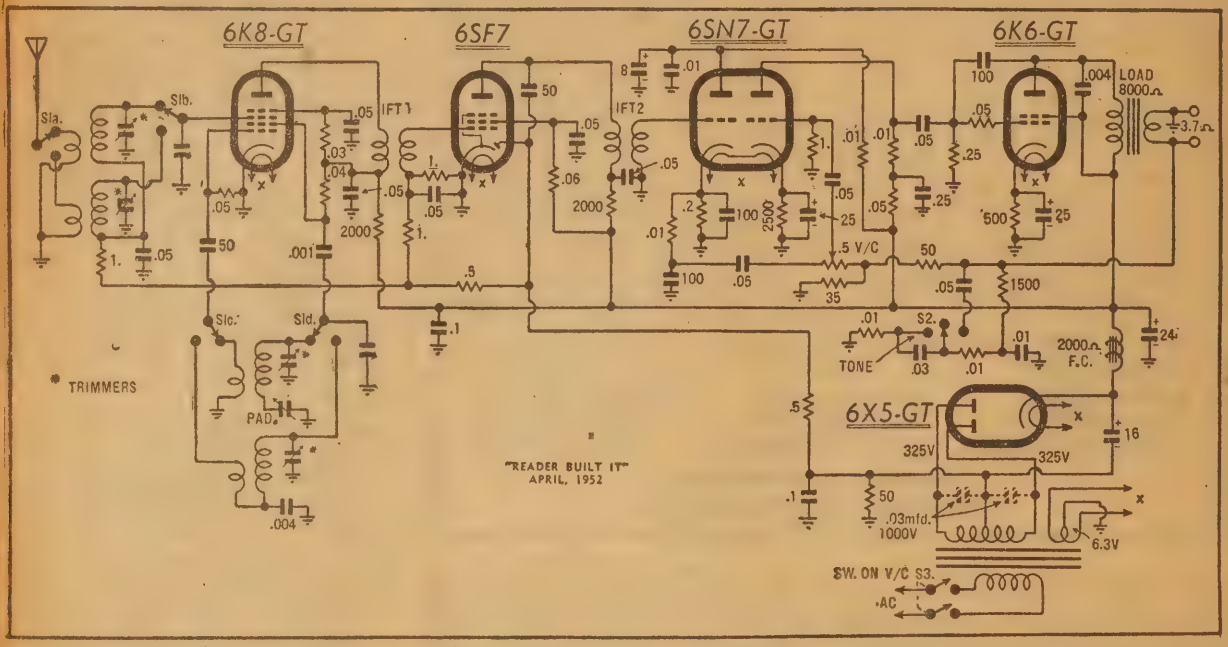
If attempts to repair defective resistors are unsuccessful, the old coating should be removed completely and a new resistor painted in its place. The proper dimensions may be determined by trial and error, keeping in mind that the resistance is directly proportional to the length and inversely proportional to width and thickness.

The resistance material must make good contact with the printed conductors at the ends. Breaks introduced in the conductors to isolate resistors may be repaired with a bridge of conduction paint. (From "Aerovox Research Worker.")

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

A 4/5 VALVE SUPERHET OF AMBITIOUS DESIGN



This month we present a 4/5 dual wave receiver which, in the words of the contributor, has some special features including a plate-tuned oscillator, reduced AVC on the IF amplifier, infinite impedance detector and variable-feedback tone control. It may be sufficiently different to appeal to you.

OUR contributor, Mr. H. Bosch, of 46 Dornoch Terrace, West End, Brisbane, Q., says that this design is the result of numerous "trials and rearrangements" in producing a set to do a specific job. Each feature has a particular reason for its incorporation.

The stage sequence is 6K8-GT converter, 6SF7 IF amplifier and AVC, 6SN7-GT reflex detector and audio driver, 6K6-GT audio power output, 6X5-GT rectifier. Some of these valves may not be on hand, but alternative types could be pressed into service.

CONVERTER STAGE

In the converter stage, the oscillator section is plate-tuned, a method which tends toward improved stability of the oscillator on the short-wave bands, as opposed to "grid-tuning." The use of "padder feedback" helps when attempting to maintain adequate strength of oscillation over the whole short-wave tuning range. Our contributor found it necessary to do this in some of the sets which he built to this design.

Decoupling is also used between the converter HT feed point and the HT line.

The choice of using a 4-5 dual wave coil unit or wiring individual coils to an appropriate switch is a matter for the constructor. The coil unit idea is easier, but the latter attack is probably cheaper.

The circuit is shown with the wave-change switch wiring included to assist where the choice is for individual coils. The wave-change switch can be a 4-pole, 2-position or a 3-pole, 3-position, 2-gang. With the latter type of switch, a spare section can be used to switch in a pick-up if desired.

The 6SF7 IF amplifier could be replaced by the Australian-made 6AR7-GT with both diode anodes connected together. This valve has slightly higher Gm and normally requires care in the wiring of the stage to ensure that there is no undesirable coupling between the input and output circuits. The 2000 ohm and the .05 mfd minimise such coupling through the HT line.

For the 6AR7-GT, the screen resistor should go up to about .075 megohm and the standing bias could well be increased to something closer to 2 volts.

This could be accomplished by increasing the 1 megohm resistor at the "earth" end of the AVC divider network to 1.5 megohms and decreasing the next one to .5 megohm or by increasing the value of the back-bias resistor between the transformer centre-tap and chassis to about 75 ohms or by making both of these changes.

Under normal circumstances, the developed AVC voltage may render these small modifications unnecessary, but they would be one of the steps to take if change of valve type is accompanied by instability.

OUTPUT VALVE

The familiar 6V6-GT could be used in lieu of the 6K6-GT if desired, the only changes involved being the reduction of the cathode bias resistor to 250 ohms and the selection of 5000 ohms as the optimum load figure.

The power transformer should be rated at 80 mA if a 6V6-GT is used with normal bias, but may be 60 mA if the 6K6-GT is used or if a 6V6-GT is operated with a bias resistor of about 400 ohms. This is an over-biased condition sometimes used to restrict the current drain.

If a permagnetic speaker is to be used in lieu of the electro-dynamic type, the 2000-ohm field coil in the filter should be replaced by a standard filter choke and a power transformer of 285 volts a side used. It may be necessary to change to a 5Y3-GT rectifier to keep the volts down or insert a wire-wound resistor (250 to 500 ohms) between the rectifier output and the filter.

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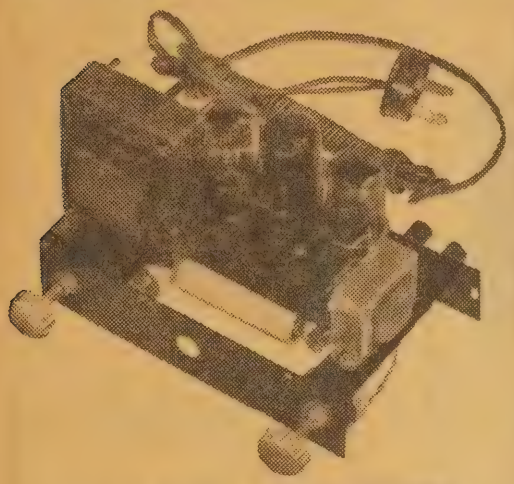

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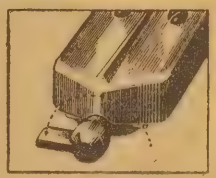


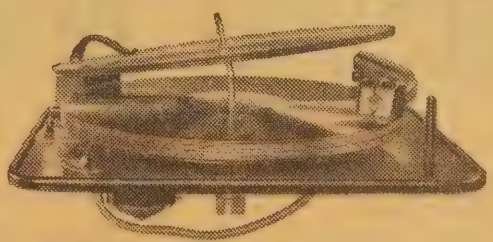
Position for playing L.P. records (red uppermost).

Position of cartridge lever for playing Standard Records.

MODEL 101 WILL PLAY: **£25.12.6**

Seven 12" either standard or long-playing records. Nine 10" either standard or long-playing records. Ten 7" 33 1-3 r.p.m. records. Ten 7" 45 r.p.m. records

The Pick-Up cartridge supplied with this unit is the turnover dual needle high impedance crystal type, suitable for playing both standard and long-playing records.



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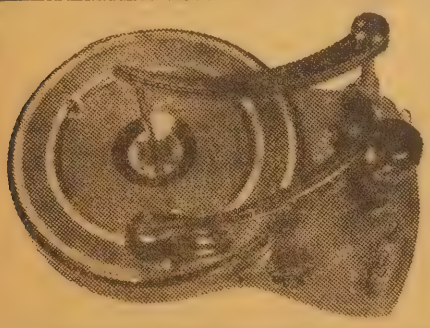

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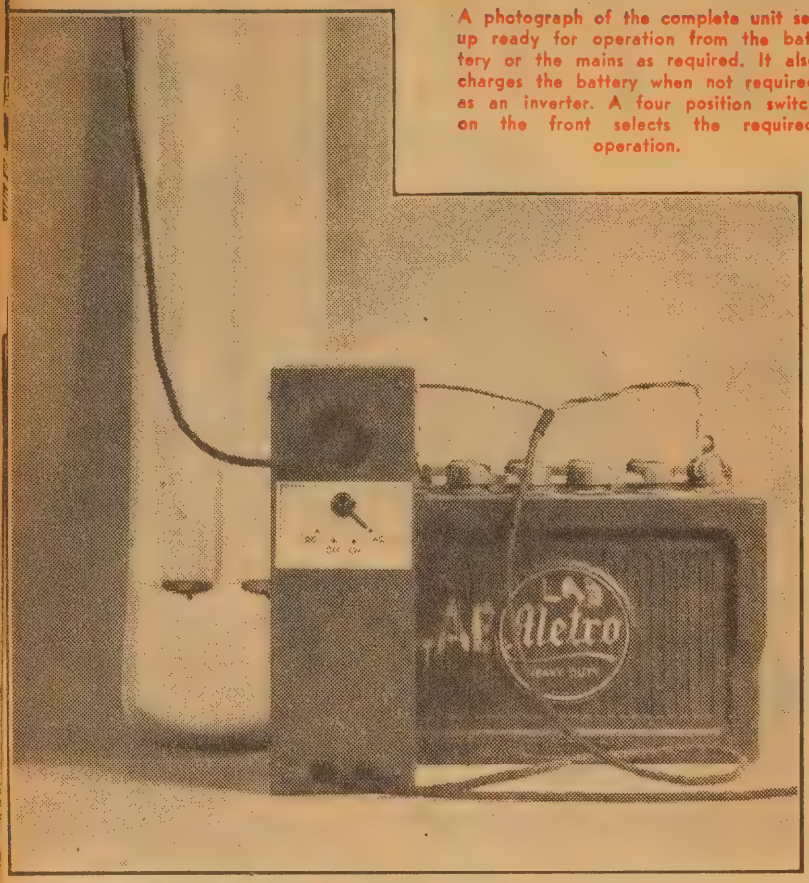


A photograph of the complete unit set up ready for operation from the battery or the mains as required. It also charges the battery when not required as an inverter. A four position switch on the front selects the required operation.

FLUORESCENT BLACKOUT LIGHT

Last month we discussed methods of providin g emergency light with an accumulator and filament lamps of various types and sizes. This mon th we present an alternative approach; that of operating a standard fluorescent lamp from a n accumulator, using a vibrator and transformer to step the voltage up to 240.

THERE is no doubt that light from a fluorescent tube is superior in every way and, although the additional expense may not be justified in the home, there are plenty of business people who have gone to considerable expense to install this form of lighting and would welcome the opportunity to retain its advantages during a blackout.

The unit described here provides this facility and, at the same time, makes provision for charging the battery and operating the light from the mains in the normal way when power is available.

The design of the unit centres around two units developed specially for this kind of work; a ballast choke designed to operate on both the 50-cycle mains current and the 100 cycles (approximately) available from a vibrator, and a transformer which performs the dual role of stepping the mains voltage down for battery charging and stepping the battery voltage up to 240 to operate the lamp.

By this means cost is kept at a minimum, since the transformer, rectifier and ballast resistor would be required in any system, while the ballast choke and condenser are a normal part of any fluorescent lamp circuit. The only really additional parts, therefore, are the vibrator, switch, wire wound resistor, and a .5 mfd paper condenser.

The vibrator is one of the dual interrupter variety which are specially designed to handle heavy primary currents. The 6-volt type are capable of delivering about 40 watts at 240 volts, while the 12-volt version will do a little better, due to the lighter current load on the primary contacts. Thus such a unit can be expected to operate a 40-watt fluorescent light without being pushed to its maximum ratings, a feature which should result in a minimum of vibrator troubles.

A 40-watt fluorescent lamp is not to be compared with a filament lamp of the same rating, even if it is of the low voltage, high efficiency type mentioned last month. The fluorescent type gives from two and a half to three times the amount of light, for the same power consumption, as does the filament type. Thus 40 watts expended in this way provide about as much light as 100 watts in a filament lamp.

Our unit is shown operating a twin 20-watt unit, but we would recommend a single 40-watt tube in preference. Although ours functioned quite satisfactorily, we understand that the starters for this size tube are inclined to be troublesome and will behave erratically if not correctly balanced.

As well as operating a lamp, the unit can also be used for other appliances which come within the wattage rating and which are not likely to be adversely affected by the higher frequency or the square wave form. Such devices would be: Small radio sets, such as 4-valve mantel types, test instruments in a service shop, a small soldering iron, and certain types of hair clippers and shavers.

However, the output socket provided for the lamp is wired to the ballast choke and this connection is suitable for the lamp only. If it is intended to operate other devices it will be necessary to fit a second socket wired to the other side of the choke, as shown dotted in the diagram.

A four position switch on the front of the unit selects the various operating conditions as follows: In the "DC" position the low voltage side of the transformer is connected to the vibrator and battery, the charging rectifier is disconnected, and the vibrator coil is energised. The 240-volt side is connected to the lamp via the special tapping on the ballast choke.

In the "OFF" position all functions cease.

In the "CH" position the transformer 240-volt winding is connected to the mains and the low voltage winding is connected to the rectifier and battery. Charging rate is approximately 3 amps.

In the "AC" position the lamp is connected to the mains through the full ballast choke winding, and, normally, all other functions cease. However, there are some interesting alternatives to this position, depending on individual requirements. By arranging a couple of extra links on the switch it would be possible to have the battery on charge at the same time as the lamp was operating from the mains.

Where the lamp is operated for an hour or so each day this will ensure that the battery is always "topped up" and not likely to run

flat due to its own internal losses. On the other hand, in poorly lighted locations, it may be necessary to run the light from the mains for most of the day, thus severely restricting the available charging time unless the battery can be charged simultaneously with the lighting.

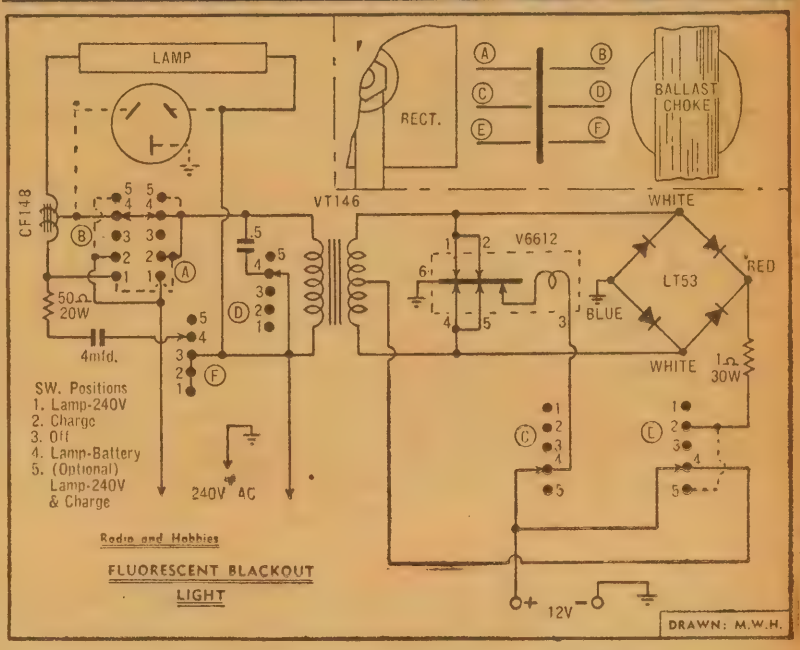
In cases like this it is convenient to be able to select either the lamp circuit only or the lamp and battery charger together, depending on the condition of the battery. This can be done by using the fifth set of contacts on the switch, normally unused, to give the alternative condition of lamp and charger together. The necessary connections for this are also shown dotted in the circuit.

The switch used to select the various operations is a 6-pole, 5-position type, consisting of 3 decks, each being 2-pole, 5-positions. The small sketch in the circuit diagram shows physical position of the decks, the letters corresponding to those in the circuit. It is not essential to follow this arrangement, but we found it about the most convenient when used with our particular layout.

A good idea of this layout can be obtained from the photograph, but this need not be followed in detail and the unit could be built in almost any reasonable form.

Main point to watch is ventilation, particularly as it affects the rectifier, and a free movement of air is essential if this is not to overheat. The

CIRCUIT DIAGRAM OF THE UNIT



The circuit should be quite easy to follow for anyone accustomed to building sets. Letters on the switch decks in the upper right hand corner refer to various sections of the switch shown in the circuit proper.

PARTS LIST

- 1 special transformer, Ferguson VT146 or similar.
- 1 special ballast choke, Ferguson CF148 or similar.
- 1 vibrator type V6612.
- 1 4 mfd, 240 volt working can type condenser.
- 1 3 deck, 2 pole, 5 position switch.
- 1 LT53 rectifier.
- 1 50 ohm 20 watt resistor.
- 1 1 ohm 30 watt resistor.
- 1 .5 mfd, 400V paper condenser.
- 1 chassis and case (see text).

Three pin plug and socket, flex, battery clips, pointer knob, tag strips, hook up wire, nuts and bolts, etc.

makers recommend that it be mounted vertically, as a horizontal position will prevent a free flow of air past the cooling fins.

It is also unwise to move the position of the mounting bracket as this is held under the same nut that holds the main assembly and the pressure required here is rather critical if the rectifier is to function correctly.

Our chassis measured 11 7-8in x 3 7-8in x ¾in and was mounted inside the lid of the metal box by means of a 1¼in x 1-8in bolt at each corner, using additional nut to achieve the required spacing. The case measures 12in x 4 3-16in x 5 9-16in, outside dimensions, while the lid is a neat fit over this and is ¼in deep. As the layout is not critical we do not propose to prepare blueprints for the case or chassis, but those who would prefer to follow the original design should be able to from the photographs and above dimensions.

The unit is designed to stand upright and to provide adequate ventilation we found it necessary to punch five holes, actually 1 1-8in socket holes, in the top of the case above the rectifier and ballast resistor.

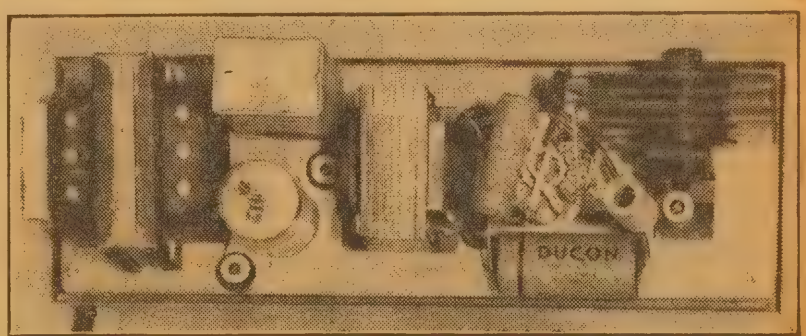
To provide an air inlet four similar holes were punched about halfway up the case, one on each side and two at the back, in positions where they would not be blocked by the major components. If a case is being made commercially these openings can be in the form of louvres and should provide at least this area if the ventilation is to be adequate.

Two heavy duty wire wound resistors are required, one a 50-ohm 20-watt and the other a one-ohm 30-watt. The first is connected in series with the 4 mfd phase correcting condenser used in the lamp circuit and is necessary to prevent a serious "splat" between switch contacts whenever this condenser is brought into circuit. It may be possible to use a 10-watt resistor in this position but it would require more ventilation than is normally available in a container such as we used.

The one-ohm 30-watt unit is required as a ballast resistor in the battery-charging circuit and is necessary to prevent an excessive charging rate with a discharged battery. This arrangement is similar to the Radio and Hobbies Battery Charger described in November, 1950, the rectifier also being the same type the LT53.

If you do not intend to use the fifth-switch position, the unused contacts on the upper deck (A) and (B) may be used as anchor points, one being used in our case to mount the 50-ohm resistor. It is not advisable to use other blank contacts without investigating the circuit very carefully, due to the possibility

(Continued on Page 108)



This close up picture shows the layout of the major components and should enable anyone to construct a unit on similar lines to the original. Leads for the battery and power are taken through holes in lid to which the chassis is attached.

Let's Buy An Argument

How sharp is "selective," how wide is "broad" and to what extent do these familiar terms modify the programs we hear over the air. It might not be a bad idea to stop talking in general terms and to digest a few facts and figures relative to familiar circuits and components. If the article reads like the account of a day's experiments, don't be surprised—for that's exactly what it is.

by W. N. Williams

THE train of thought actually started (admittedly for the "umpteenth" time) when I read a tale of woe from an English listener, who had apparently equipped himself with some kind of filter. He was complaining bitterly that the BBC were radiating some programs which had a top response limit of about 2000 cps.

Now, I am by no means an authority on listening conditions in Great Britain, but it seems unbelievable that an institution like the BBC would tolerate recordings, landlines or anything else that imposed such a drastic limitation on their program quality.

I strongly suspect that the complainant was unwittingly measuring, not the BBC program content at all, but the response curve of his own receiver.

It's amazing how many folk in this technically enlightened age, continue to know but equally to ignore the effect of tuned circuit selectivity on treble response.

Over and over again, our own correspondents go into raptures about their wide-range gear and mention, as a mere afterthought, a very ordinary kind of tuner. They know all about selectivity, to be sure, but the way it actually limits results never seems to register with them!

When will we get it into our thick skulls that fidelity doesn't just begin at the amplifier input? You can lose the highs, distort the rest and addle everything on the way through the tuner and out the detector.

I know it isn't easy to build a tuner with a pure, level response. This point has been made in these columns times out of number, and, unless someone gets a brilliant inspiration, it's going to remain a difficult (though not impossible) task. But, for heaven's sake, let's appreciate what we are up against. At least that will be something.

Well, then, how good or bad are the available programs in terms of frequency response? Do they warrant any special efforts on our part.

The question is rather akin to the old one about the length of a piece of string. There are so many variables in the way of program material, line arrangements and so on, that one station engineer we asked recently, shrugged his shoulders and refused to commit himself.

EFFORTS ARE MADE

Actually, the engineering staffs do make an effort to keep the equipment in trim, though circumstances often force the use of program material which is technically not the best.

In Sydney, for example, the two ABC stations (2FC and 2BL) run a frequency and distortion test after closing each Thursday evening. Frequencies up to 10 Kc are fed, at constant amplitude, into the studio circuits, then through the landlines to the transmitter. The radiated signal is picked up and rectified by a simple diode detector, the audio component being shown on a meter.

In other words, as far as the engineers are concerned, the line and transmission equipment is substantially flat overall to 10 Kc. After that, I guess, it would taper off.

If you are interested to cross-check your own set's performance connect an output meter to the final plate circuit — or preferably the voice coil — tune the receiver carefully, then watch results as the modulating frequency rises.

To get back to the point, however, what we really want to know is the frequency range of the actual programs which the stations radiate in the course of a day's activities.

Permit me to volunteer a few suggestions, based on listening tests with wide-range gear and frequent manipulation of a calibrated top-cut filter.

1. Programs from average-to-good, 78 rpm discs are usable up to about 6½ Kc. Surface noise and inner groove distortion is often serious beyond that and is often filtered anyway at the station.

2. All but bad studio transcriptions are good to 8½ Kc. Heterodyne whistles enforce a cut in the tuner at 10 Kc and the value of anything left over on the discs above that is problematical.

3. Studio broadcasts (rather rare) and "live" programs by landline may be slightly better or worse than transcriptions but, by and large, much the same remarks apply.

4. Microgroove records will generally be good to 8 or 9 Kc and we'll swear to a few programs running up above 13 Kc. Much depends on the station's choice of a pickup and whether they use de-emphasis or pump the treble out as it stands with 10 or 12 db of pre-emphasis. Station engineers don't appear to have reached any agreement on this point as to what is the best procedure.

You may or may not agree in detail with these figures, but they won't be too far out. The question now is how much of the available frequency spectrum are we likely to hear on a typical set. Let's start with the sad part of the story—and how sad it is!

FIRST TEST

While we were setting up the gear, there happened upon the bench a slightly ancient but not unusual commercial dual-wave set, of which there must be thousands in circulation. It sounded rather deep—classically "nice and mellow"—but would otherwise pass muster as a perfectly normal furniture store "bargain."

We duly connected a vacuum tube voltmeter across the output plate circuit, and fed a signal generator in the front end. The generator was, in turn, modulated from an external audio generator and the modulation carefully held to the nominal figure of 50 pc.

The set was carefully aligned with 400 cps. as the reference figure, and the frequency was then increased in steps while the output was observed. The result is there for you to see as the solid line of figure 1.

I agree that it seems incredible but, with the tone control wide open, the overall response of the set, related to 400 cps. is down by just on 15 db at 3Kc.

And that's not all. With the tone control set in the "mellow" position, the signal level dropped by some 20 db, even at 400 cps. But, referred to the same point on the curve, the response was now down 15 db at 1500 cps.

THE REASON WHY

By way of explanation, the set had a pair of selective IF transformers to begin with. In addition, we found a .0005 and a .00025 condenser loaded across the diodes circuit, another .0005 across the audio plate circuit and a .01 from the final grid to ground as the tone control condenser. Nor was there any feedback to mitigate the effect of these condensers.

I never expect to see a worse set than this, but it does show what you can buy with good money. Fortunately, most modern commercial sets at least go easy on the audio bypassing, even if the IF transformers are still there to trim off the sidebands.

Well then, how effectively does a more typical superhet do this?

As the next step, we took a standard 4/5 valve superset tuner, which had shown itself capable of an excellent performance on the air — at least in respect to its ability to log stations cleanly and well. It happened to contain a set of "Q-Plus" coils and IF transformers, but the brand is less important than the fact that they represent fairly advanced design—litz windings, metal cores and cups (I think) and apparent critical coupling.

Now take a look at the solid curve in figure 2. You can reckon that it will represent pretty closely what you can expect out of your pet high-performance superhet tuner.

Referred to 400 cps, the response is down 7 db at 3 Kc, 11 odd db at 4 Kc, and 15 db at 5 Kc. There's not

WHAT THE TOP END LOOKS LIKE

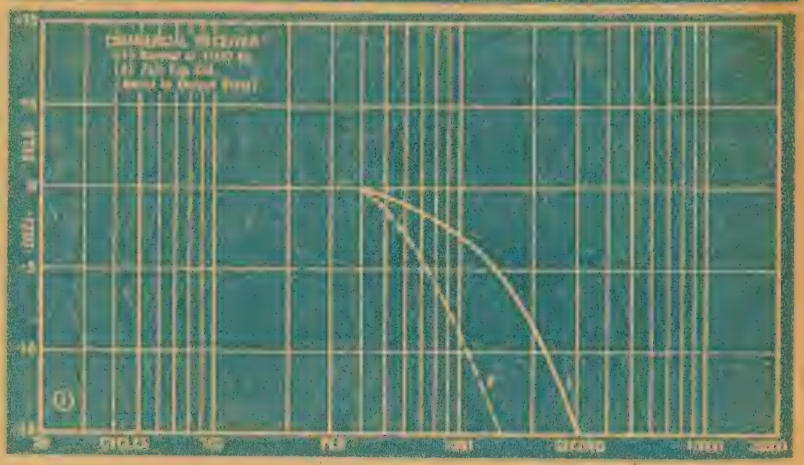


Figure 1. Almost too bad to be true. The "treble" response of a "mellow" commercial receiver, with and without tone control.

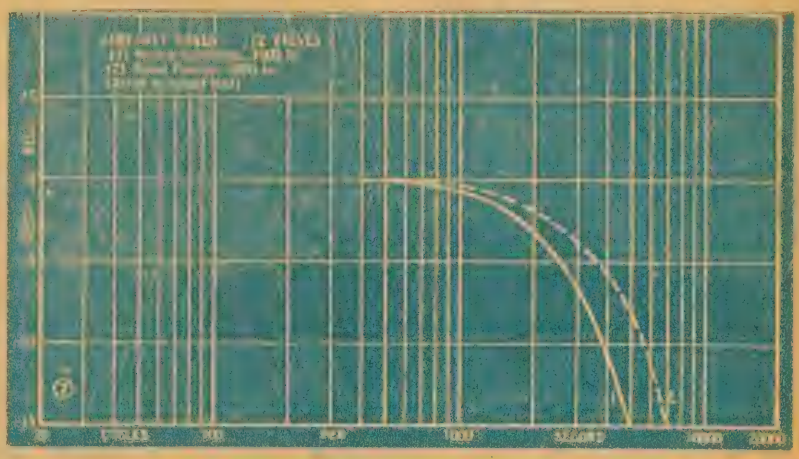


Figure 2. Response curve (solid line) for a typical high performance superhet.

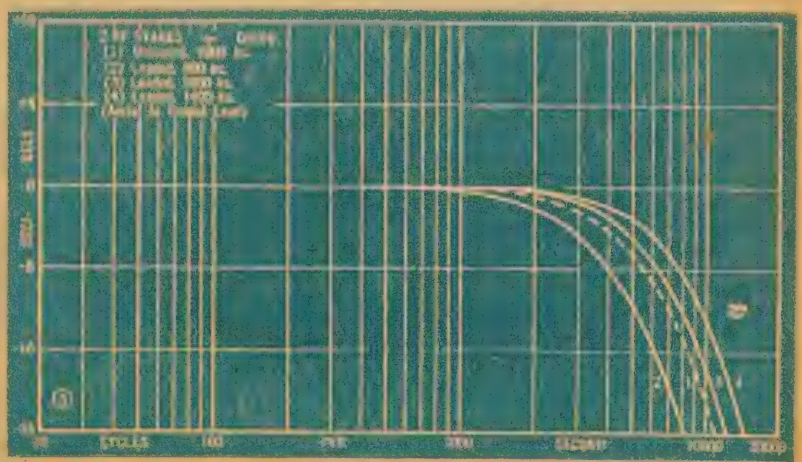


Figure 3. A set of curves for a TRF tuner. Note the marked variation according to the signal frequency.

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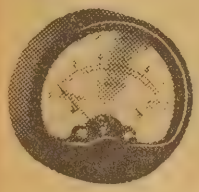

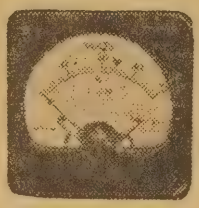

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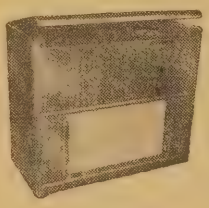

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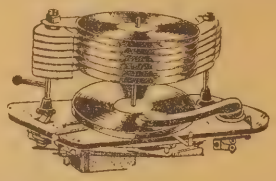

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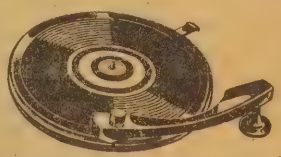

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much point in chasing the curve further down than this, but it is immediately obvious you you don't have to worry about 10 Kc. whistles with an ordinary superhet.

Now the dotted line shows what happens when one of the IF transformers is virtually switched out by our variable selectivity scheme. You gain 5 db at 4 Kc, 7 db at 5 Kc, and the 15 db "down" point shifts up to 7 Kc.

That's better, but it's still not good, and it's immediately obvious that the selectivity is being set largely by the first IF transformer.

That's why, in the "Playmaster" tuner article, we made the observation about using a wider-band IF in the first position. Remember?

ANOTHER TYPE

At this juncture, to see what would happen, we ripped out the first IF and installed another type altogether, which was blithely marked "medium selectivity." Unfortunately, the response curve turned out to be sharper than ever! We now had to work out why "medium selectivity" was sharper than "standard selectivity."

On further investigation, we found that our medium selectivity transformer was also a low gain type, by virtue of the fact that it had much larger than the usual 100 pf tuning condensers. It was low gain, all right, but a darned sight higher "Q"!

I had a little laugh, then a little cry and put the superhet aside for a while.

Let's see what a TRF could do!

The victim, in this case, was the "Playmaster" job — a perfectly standard affair with two RF stages and a diode. The whistle filter was taken out forthwith, so as not to confuse results.

The curves of figure three tell the story, which is a mixture of good and not-so-good aspects.

In the first place, the sideband losses are lower every way than in the high-performance superhet, but the selectivity varies enormously with signal frequency. I don't know whether you've thought much about this!

Using a 1000 Kc test signal, the drop, at 5 to 6 Kc, would only just begin to be noticeable to the ear. (See curve three). It is 11 db down at 10 Kc and reaches the "15 db-down-point" at about 12 Kc.

EFFECT OF LOADING

The dotted curve, incidentally, was taken without loading across the second tuned circuit, and the degree of improvement is evident. Some may be able to load the circuit more heavily or load additional circuits, but loss of gain and interference problems will soon become evident.

With a 1400 Kc test signal, the position is beginning to look quite promising (curve four), but, alas, the reverse is true at the 600 Kc end, where much of the desired music is likely to come from. The result there isn't markedly different from the superhet tuner in its broad position.

I am speaking, remember, of a tuner with all three circuits loaded down — (1) by the aerial (2) by a resistor and (3) by a diode detector. Heaven knows what the curve would look like for a TRF tuner with regeneration present or an unloaded

EFFECT OF OVERCOUPLED IFT's

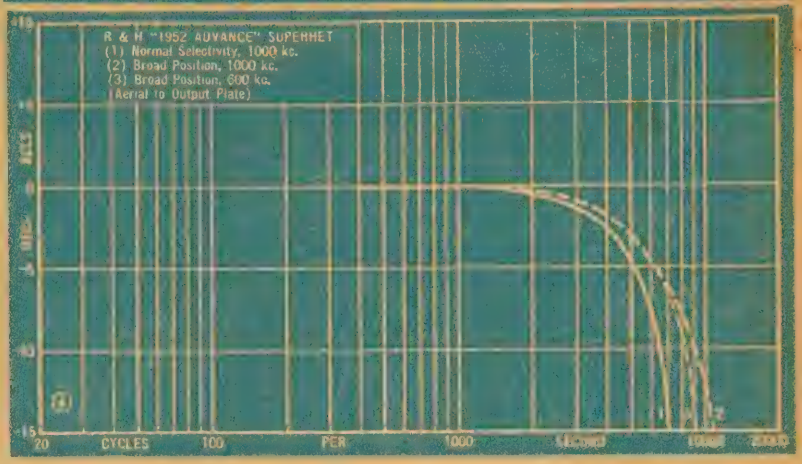


Figure 4. A surprise curve, turned out by another superhet. Explanation is in slightly over-coupled I.F. transformers.

infinite impedance detector circuit.

Actually, the matter of varying degrees of selectivity has little to do with the design of the coils — it is fundamental to the operation of a TRF.

For tuned circuits of a given number and merit, the bandwidth in Kc for a given degree of attenuation comes pretty close to being a definite proportion of the signal frequency. Looking at figure three, you will note that the 600 Kc curve crosses the minus 10 db line at 6 Kc, whereas the 1400 Kc curve crosses the same line at 12 Kc.

In other words, you double the signal frequency and up goes the bandwidth by roughly the same amount. If you load down the circuits to make the set broad enough at the low frequency end, not enough selectivity is left at the other end to separate the stations.

I'll have more to say about this anon.

In the meantime, as a check on the general accuracy of our curves, we dug out the "1952 Advance," having a variable selectivity feature and using another brand of coils and IF transformers. (RCS to be precise).

DIFFERENT CURVE!

The resulting curves, shown in figure four, were of quite different shape from those of the other tuners. Even in the sharp position, the response was down only 5 db at 5 Kc, yet the curve rolled off very sharply between 7 and 8 Kc. On the broad position, the response curve looked generally better than the TRF and was not greatly affected by signal frequency.

Where the heck, the difference?

If you regard the treble response curve as representing half of the selectivity envelope, it is obviously approaching the flat-top characteristic. For a DX fan, this would be bad, but it's just the reverse for the wide-range enthusiast. It looked very much as if the IF transformers were slightly overcoupled.

So we took the bull by the horns and rang the manufacturer. "Sure thing," he assured us, "We deliberately wind 'em that way. It doesn't affect the gain much or the ability to separate stations, but it does make them easier to align."

To this we added . . . "And it does let more sidebands through."

Funny, the things you can dig out from under the branding "standard selectivity."

So much for that. Maybe we could make the original tuner look just as good by loading down the first IF to round off the nose of its curve. We turned back to figure two for reference and began loading resistors across the windings, but to no real purpose.

The response could be made just as broad as the "Advance" at the "15 db-down" line, but there was no bump at 5 Kc. By the time we had pulled up the response at 5Kc the tuner had no gain left worth speaking of, and the "skirts" further down were hopelessly broad.

BY WAY OF CONCLUSION

It was obvious that there was only one way to duplicate the response curve of figure 4—namely to take out the original first IF transformer and either replace it with an overcoupled type or try to modify it by pushing the windings a little closer together.

At this point the article must come to an abrupt and rather unseemly conclusion. There's a limit to the time one can spend at the bench on any one subject in any one month!

However, I can draw certain inferences from the foregoing for you to get your teeth into. They're not by any means new but their restatement mightn't be a bad thing at this stage. Let's put them down.

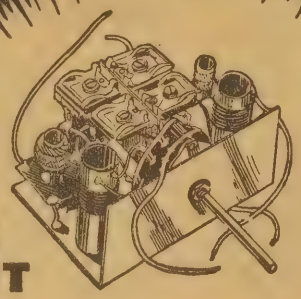
(1) The TRF remains as an easy way out to get wider bandwidth but it still falls well short of the optimum justified by the best available programs.

(2) The principle of loading circuits with resistors to broaden their response is very much a compromise. The gain and ability to separate stations is sacrificed well before the top of the response curve is rendered anywhere near flat.

(3) The variation in bandwidth with signal frequency is a fundamental disadvantage of the simple TRF. It makes a superhet with a

(Continued on Page 106)

HITS in KITS!



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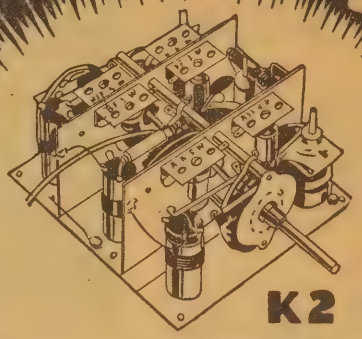

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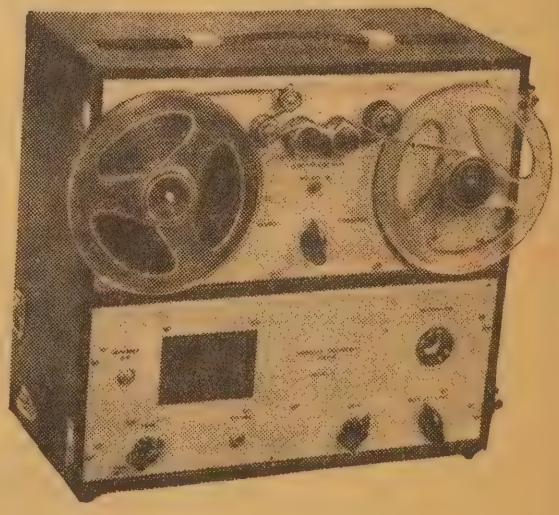

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TRADE REVIEWS AND RELEASES

For industrial and switchboard applications, Messrs. Paton Electrical Pty. Ltd., are now marketing a wide range of ammeters and voltmeters. Two typical instruments are illustrated on the right.

THE round projection type meter is designated as model 600 and is classified as a heavy duty instrument suitable for power station, sub-station and industrial application. It is a 6in moving-iron repulsion type, with self-shielding metal vanes, tungsten-steel pivots and synthetic sapphire jewels. It employs a damping chamber and is completely shielded.

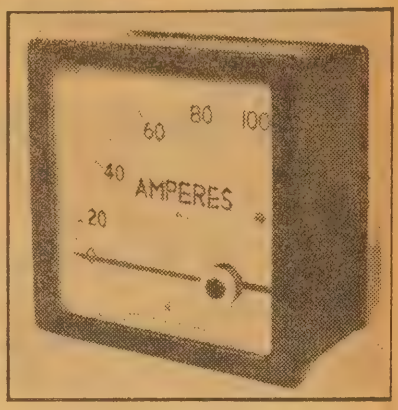
Finish of the instrument is matte black and the movement is accessible without removing the instrument from the panel. The instrument has a high degree of accuracy, a liberal overload characteristic and will operate at full load without overheating.

Current ranges are 0/20 and 0/200 amps and 0/5 to 0/1000 volts. Frequency range is 25-100 cps, also DC. The scale is approximately linear.

Model 558-Q is electrically similar to the model 600 but is housed in a 6in square case, which can be either flush or projection mounted. The styling of case, scale and pointer lends itself to modern panel treatment.

Other instruments in the range include the model 550, which is a 6in square metal-cased meter designed especially for flush panel mounting. Model 500 is a flush mounting 5in instrument with round case, while the 434 is a bakelite cased meter, classified as 4in flush, and with either round or square bezel as required.

All the above instruments are available for prompt delivery and full service facilities are provided. Price and full specifications are available on application to Paton Electrical Pty. Ltd., 90-94 Victoria St., Ashfield, NSW.



Typical industrial meters in the Paton range. Above the 6" square model 558-Q and on the left, the 6" round model 600. Voltmeters to 500 normally employ in-built multipliers.

NEW SPEAKERS

OF special interest to amplifier enthusiasts is the recent announcement by J. H. Magrath and Co. Ltd. that they have received stocks of the well-known Stentorian concentric speakers.

Two sizes are available—a 10in and a 12in diameter unit. The 10in speaker is intended primarily for better quality domestic listening. It is virtually two complete speakers in one, with separate gaps and separate voice coils for the high and low frequency units.

The low frequency unit has a 3-ohm coil and the high frequency unit a 30 ohm coil. Composite power handling capacity is 6 watts.

The maker's curves indicate a substantially flat response to 5000 cps, then a taper to another substantially flat region 12 db down and extending to approximately 14 Kc.

The 12in speaker employs a generally similar principle but has more ambitious specifications. It has an in-built cross-over network operating at 15-ohms input and has a power rating of 15 watts. Magnet flux density is extremely high and maker's curves indicate a substantially flat response from 30-17,000 cps.

Further details may be obtained from J. H. Magrath and Co. Pty. Ltd., 208 Lt. Lonsdale St., Melbourne.

ROBINSON ELECTRONIC VOLTMETER

Popular with service establishments and in laboratories, the Robinson Electronic voltmeter has been further improved by the addition of a decibel scale to the meter face. Centred on the 6 milliwatt reference, the scale provides for a range of plus 5 to minus 18db.

THE instrument uses the familiar twin-triode balanced bridge circuit, with internal and external diodes to cover AC readings. The internal diode covers the entire audio and low RF spectrum, while the probe extends the frequency range to at least 100 Mc. Valves are selected to minimise errors due to grid current and contact potential.

On DC, the instrument measures from 3 to 1800 volts while, on AC, the ranges cover from 3 to 600 volts. A special multiple scale minimises reading difficulties. For negative DC, a setting is available for measurements of AVC voltages, &c., allowing the case of the instrument to be earthed at all times.

A zero adjustment is provided for initially setting the pointer but range multipliers and corrections are switched in automatically by the range-change switch. These are selected individually during the process of factory calibration.

For resistance measurement, direct reading values cover from 0.2 to 1000 megohms in five steps.

Overall size of the instrument is 9¾ x 8½ x 8½ and the weight is 15lb. Price for the month of April only is £31/10/-, plus 12½ pc sales tax. Inquiries to Robinson Electronic Laboratories, 107 Parramatta Rd., Haberfield, NSW.

WE would remind readers that Radio and Hobbies does not deal in radio components, and any enquiries regarding goods described in these pages, advertisements, or constructional articles should be referred to the makers or their agents. This also applies to complete kits of parts for Radio and Hobbies circuits, and requests for prices etc. should be referred to our advertisers.

E. M. I. MAGNETIC RECORDING TAPE

IS NOW AVAILABLE WITH HIGH COERCIVITY COATING

"EMITAPE," the result of many years' research at E.M.I. Factories Ltd., England, makes possible the attainment of wide range recording at slower tape speeds.

Whatever your magnetic recording requirements may be you should consider these points:

- **Frequency Response*: Plus and minus 2 db of the response at 1000 c.p.s. over the range 50-15,000 c.p.s. at 15"/second. 50-8000 c.p.s. at 7½"/second. 50-4000 c.p.s at 3¾"/second.**
- **Signal/noise ratio*: 60 db (unweighted) below peak recording level (2% total harmonic distortion) measured over a band width of 50-15,000 c.p.s.**

HIGH COERCIVITY EMITAPE
TECHNICAL DATA

Thickness	
Backing	.0016"
Coating	.0005"
Total	.0021"
Tape Width	.25" + 0 —.004"
Tensile Strength	4½lb per ¼" width.
Elastic Elongation at 1lb	Less than .5%.
Recommended Operation Tension	3oz.
Yield Point	4lb.
Longitudinal Humidity Coefficient	8 x 10 - 3% per % R.H. (40—95% R.H. at 77°F.)
Longitudinal Thermal Coefficient	5 x 10 - 3% per °F. (30—130°F.)
Coercivity	270 oer.
Remanence	.50 flux lines per ¼".
Print Level at 15"/sec.	—60 db. for 5 minute contact and instantaneous playback at 65°F.
Instantaneous variation in Sensitivity along tape length-maximum	Plus and minus 1½ db.

* *Measured on an EMI Tape Recorder.*

"EMITAPE" is available as follows:—

HC COATING	LC COATING
Type H60/6 600' reels £1/14/6	Type 65/12 1200' reels £2/18/-
Type H60/12 1200' reels £2/18/-	

3250' spools with EMI hubs available for professional tape recorders.

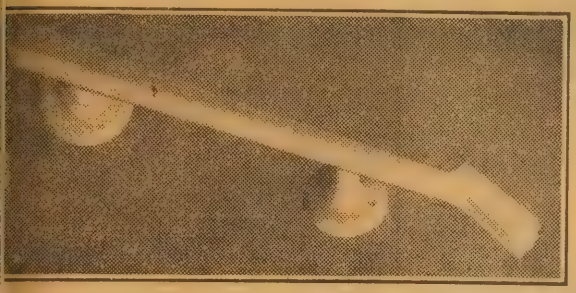
Available from leading electrical and radio supply houses.

State Distributors:

NSW: E.M.I. Sales & Service (NSW) Pty. Ltd., 2 Parramatta Rd., Homebush.
Victoria and Tasmania: E.M.I. Sales & Service (Vic.) Pty. Ltd., 167 Flinders Lane, Melbourne.
South Australia: E.M.I. Sales & Service (Vic.) Pty. Ltd., 265 Rundle St., Adelaide.
Western Australia: Wyper Howard Ltd., 671-3 Hay St., Perth.
Queensland: A. E. Harrold, 123-125 Charlotte St., Brisbane.

NEW RANGE OF CRYSTAL UNITS

AWA have recently announced the release of a comprehensive range of crystal microphones, crystal pickups and smaller units of a similar nature. Manufactured in Holland, they will be marketed in Australia under the name "AWA Ronette."



HM "Handmicrophone," as illustrated. It is normally fitted with a filtercell unit and can be supplied with varying response curves for specific applications.

Of the more ambitious lines, model R474 is typical. This employs quadruple cells, has a high output and is claimed to be substantially flat over the complete range of audible frequencies. Low impendance, transformer output can be provided.

Further inquiries to AWA, 47 York St., Sydney.

Multicell microphone type R474.

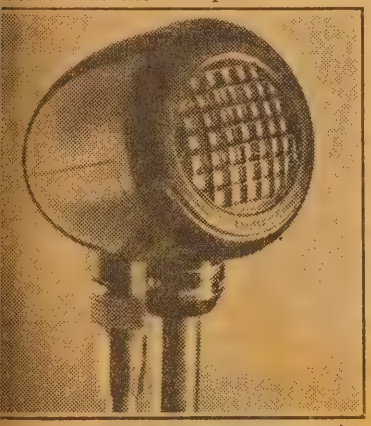
)F the pickups and attachments, main interest centres around ree pickups, which can be used her with 78 rpm or microgroove ics.

The pickups have the same mould- cream bakelite arm, but use cart- lges of varying specifications and ice. A cantilever stylus is used, th a damping block between the /lus arm and the surface of the rtridge.

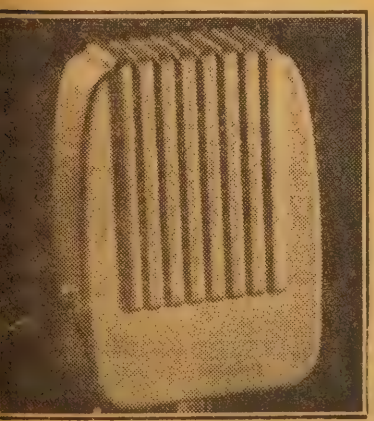
A microphone insert is listed, also interesting "contact" microphone r special applications.

Microphone type B110 is housed in streamlined plastic case and is re- tively inexpensive. It is intend- for home entertainment, amateur ations, paging systems and PA ork.

Somewhat more expensive is the



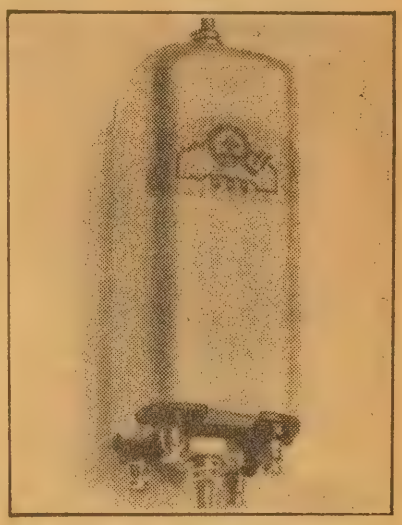
Model B110 is an inexpensive speech type.



Model HM, which can be used either in the hand or on a stand.

MINIATURE 1600 kc IFT's FROM Q-PLUS

CONSTRUCTORS of small equipments will be interested to know that Messrs. R. W. Steane and Co. Pty. Ltd. have released a 1600 Kc IF transformer in their standard miniature can. These measure ¾" square

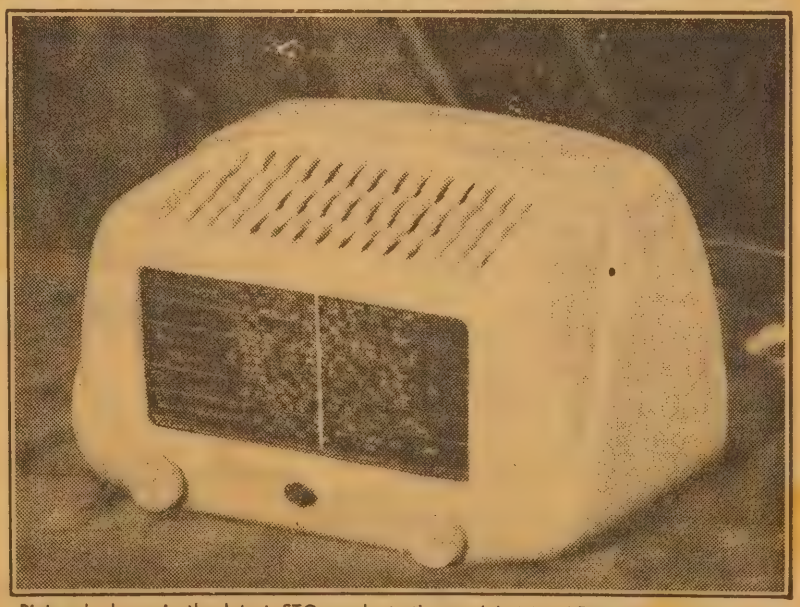


and 1¾" high, excluding the adjusting slugs.

The transformers are supplied for No. 1 and No. 2 positions, the two types employing slightly different coupling factors. The coupling is adjusted for good selectivity and adequate gain in conjunction with high-slope miniature valves.

Inquiries should be placed through "Q-Plus" dealers.

FOUR-VALVE MANTEL SET FROM S.T.C.

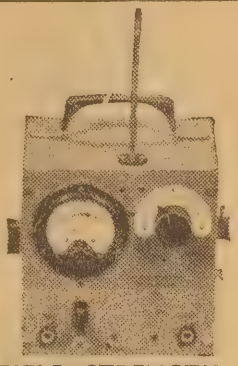


Pictured above is the latest STC product, the model A411 "Bantam." A four valve mantel receiver, it features the new 6BW6 Brimar output valve, mentioned in these columns last month. The styling of the cabinet and colors (the one above was coral pink) will merge well with modern pastel shades. Distribution will be through normal STC trade dealers.

American Radar Transmitter Type ASB

CONTAINS—

Four UHF Triodes, Type 15E.
One High Voltage Rectifier, Type 15R.
Four sets of Lecher Bars.
Transformers, ceramic mountings, Motor Blower, etc. Also High Voltage Vacuum Change Over Relay, Nominal Frequency 515 m/cs. Ideal for Conversion to UHF Channels. Variable Coaxial Cable and Link Matching lines. Contained in Aluminium Case, dimensions 18" x 7" x 8". . . . . PRICE, each F.O.R. £6/10/-
The parts are worth considerably more.



FIELD STRENGTH METER-MONITOR

TYPE 98

Frequency range 100-130 m/cs or can be converted to any other freq. range by altering one coil. Complete with IN5G valve, imported 3-inch 0-1 MA meter and chrome-plated telescopic aerial, Jack provided for using meter for external measurements, also necessary plug and lead. Batteries encased within the unit. Size 6½ x 7 x 7 inches. Supplied in portable carrying case.
Price, New, Complete, less batteries, F.O.R. **£4/10/-**
Weight packed, 15lb.

TRANSMITTERS

Type TA12—7 valves—Range 1-8 m/cs £14/10/-

TRANSCEIVERS

Type TR1143 — 17 valves — Range 110-130 m/cs. £15/-/-
Type TR1133 — 17 valves — Range 90-130 m/cs. £10/10/-
Type 108 — 7 valves — Range 6-9 m/cs. £12/10/-

D.C. GENERATORS

12v 750 watt. Ideal Homelighting, Battery Charging, etc.
PRICE, £11/10/-, F.O.R.

IMA METER RECTIFIERS

FULL WAVE BRIDGE TYPE
Ideal for AC Meters and Multimeters, etc. 15/-
PRICE, each . . . . . .
Postage 6d each.

VIBRATOR SUPPLIES

New Mallory USA type. 12 volt input, output 110 volts at 100mA. Size 5½ x 2¾ x 4¾ inches. Complete . . 55/-
Packing and postage, NSW 3/-; Interstate 6/-.
New voltage regulated type, 24 volt input, output 135 volts at 50mA. Valve voltage regulator, non-synch, vibrator, selenium bridge rectifier and complete filter.
Size 9½ x 6½ x 3 inches. Weight 10lb.
Complete with circuit diagram. Price, each **£4/10/-**
Post NSW 4/-; Interstate 9/-.

PUSH-BUTTON SWITCHES

5-pole each 2 pair of contacts. Made In USA. Ideal for receivers, multimeters, etc.
Price, Each **12/6**
Packing and postage: NSW 9d; Interstate 1/6.

HIGH-POWER I.R.C. RHEOSTATS

250 ohm, 25 watt.
10 ohm, 2½ amp; 25 ohm, 1 amp.
Price, each **12/6**
Packing and postage 9d each.

POST OFFICE PATTERN RESISTANCE BRIDGES

Highly accurate. Range .05-100 ohms. Range can be increased to 100,000 ohms or higher with minor alterations. Complete with GALVANOMETER. Weight packed 20lb.
PRICE (F.O.R.) **£9/10/-**

DISPOSALS VALVES, TESTED

955	12/6	717A	15/-
956	12/6	VT90 Micro-pup	10/-
9001	10/-	6AC7	14/-
12A6	10/-	6AG7	20/-
12SG7	10/-	6H6GT	7/6
12SK7	10/-	6SH7	8/6
12SR7	10/-	6SH7GT	8/6
FA50	7/6	7193	5/-
CV6	5/-	954	12/6

NEW VALVES

1S5	12/6	3S4	12/6
1T4	12/6	3Q4	12/6
1R5	12/6	3A4	12/6
6C8G	14/-	83V	11/-
6H6	10/-	837	25/-
6J5G	11/-	879/2X2	15/-
6SQ7	12/6	1294	11/6
6X5GT	12/6	1293	11/6
7A6	10/-	VR54/EB34	5/-
7C7	11/6	VR65A	5/-

SHIELDED PLUGS AND SOCKETS

4-pin as illustrated. Quantity available.
Price, each **4/6**
Per doz **45/-**
Packing and postage 6d each. Per doz., NSW 1/6; Q, T, V, 2/6; NT, SA, WA 3/6.

BOOK BARGAINS

Radio Receiver Design by Sturley, Part 1 . . . . . 15/-
Practical Wireless Circuits by Camm, 5/-
High Frequency Thermionic Tubes by Harvey 12/6

24-VOLT MIDGET MOTORS SHUNT WOUND

Fully Laminated Fields. Wound Armature. May be operated from AC at a slightly higher voltage. Sixteen Segment Commutator, all bearing Armature. Ideal for Model Trains, Hobbyists, etc. Condition New.
Price, each **39/6**
Packing and postage: NSW 1/6; Interstate 2/6.

COMMUNICATIONS RECEIVERS

RCA type ARB, frequency range in four switched bands — 195-560Kcs, 560-1600Kcs, 1.6-4.5mcs, 4.5-9.05mcs. Valve line up 12SF7 RF, 12SA7 converter, 2-12SF7 IF, 12SF7 and 12A6 audio. Calibrated dial with geared drive. Complete with inbuilt genemotor supply delivering 260 volts at 70mA. Suitable for operation from 28 volts or conversion to 240 A.C.
Unpacked weight 27lb.
Price, F.O.R. **£24/17/6**

50-CYCLE A.C. AMMETERS

Range 0-14 amps.
Scale Size 4in. dia.
Brand New.
Price, each,
55/-
Packing and postage: NSW 3/-; Interstate 5/6.

METERS

0-10 mA., DC, 2-inch round flush new	22/6
0-30 mA., DC, 3-inch round flush	25/-
0-30 volt DC, 3-inch round flush with datum indicator	30/-
0-300 mA., thermocouple. New	15/-
0-3 Amp., RF, thermocouple. New Imported 2" square flush	17/6
0-4 Amp., RF, thermocouple. New Imported 2" square flush	17/6
20 mA. DC, 300 amp., scale 3in. round flush	25/-
20 volt DC, 2in square flush, imported. New	20/-
40 volt DC, 2in square flush, imported. New	20/-
0-500 mA., RF Meters, 2in flush	17/6
20 volt and 200 volt DC, 2in round dual reading, with leads. New	20/-

Packing and postage, 1/6 each.

GENEMOTORS

Midget type as illustrated input 28 volts, output 250V at 60mA. 35/-
28 volt input, output 330 volts at 135mA. Filtered 70/-
TR1133 type, input 12 volts, output 300 volts at .24 amps, 150 volts at .01 amps, 6 volts at 5 amps. Filtered. 90/-
12 volt input, output 250 volts at 100mA. 55/-
6 volt input, output 250 volts at 100mA. 90/-

SANGAMO PRECISION TIMERS

48-hour jewelled movement. Can be run continuously or for one minute periods. Ideal for photographers hobbyists, electrical flasher signs. &c. **22/6**

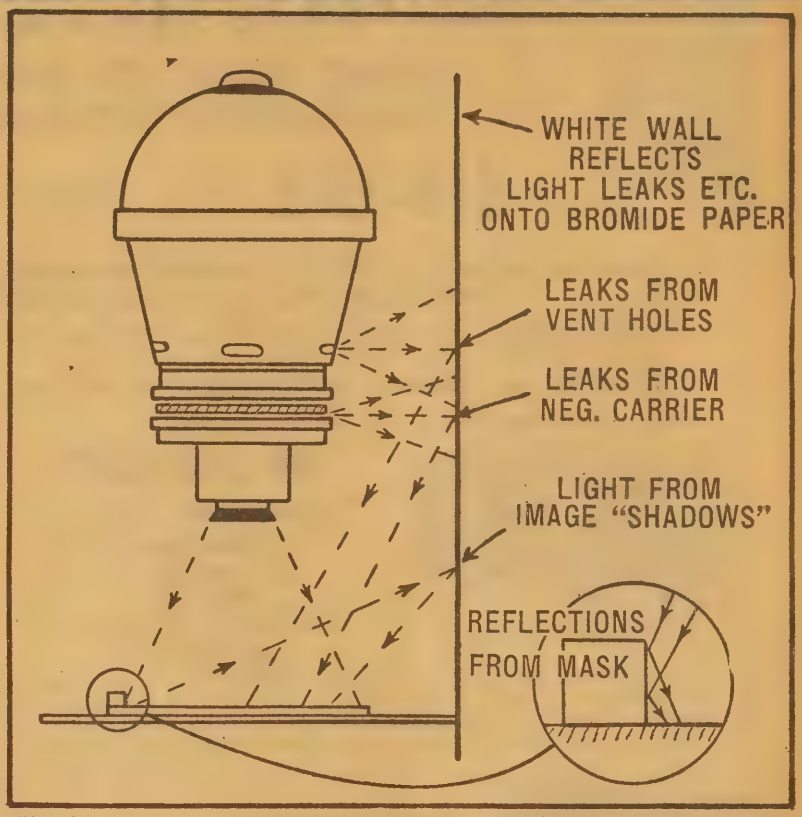
Please add exchange to all cheques. Make money orders and postal notes payable to Lewisham. Sorry, no C.O.D.

ELECTRONIC EQUIPMENT CO.

29b WEST ST., LEWISHAM, SYDNEY. **LM3555**

We do not accept responsibility for any order damaged in transit.

SOME FINER POINTS ON ENLARGING



This diagram shows some of the major causes of degraded highlights in projection prints. A light colored wall near the enlarger will reflect light leaks etc. onto the sensitive paper, while even the light from the projected image can be reflected into the wrong places.

After you have made your first few enlargements and some of the early enthusiasm has worn off you will probably be able to view your handiwork rather more critically. Do your prints look really professional? If not, or if you feel that work in the darkroom is not running as smoothly as it should, some of the points in the following article may help.

by Philip Watson

ONE of the most frequent causes of poor quality prints is fogging of the highlights, due, in turn, to light other than the direct rays from the lens reaching the paper. There are many ways in which this can happen and a complete cure sometimes involves suppressing many minor leaks, in themselves insignificant, but which, collectively, are sufficient to cause serious fog.

Actual light-leaks from the lamphouse are probably the worst, and a good many enlargers leave a lot to be desired in this respect. At the same time the problem is not an easy one, for it is obviously necessary to ventilate the lamphouse due to the considerable amount of heat which is generated in a small space. The usual method is to use light traps, i.e., ventilation holes behind which are mounted baffle plates, intended to obstruct the light rays without seriously impeding the flow of air.

LIGHT LEAKS

While the baffle plates undoubtedly block off the direct rays, it is almost impossible to suppress indirect rays reflected from the walls of the lamphouse and which thus find their way "around" the baffle plate and constitute a light leak. True, the amount of light escaping is only a tiny fraction of the total, but it is still sufficient to be serious when we consider that there are usually a number of such ventilators.

Further, the degree of leakage is not affected by the setting of the projection lens diaphragm or the density of the negative and when these are such as to require a long exposure, the light leak, still at full strength, has just that much longer to act on the paper.

To what extent these holes can be covered without creating serious ventilation problems will be a matter for experiment, and each case will have to be treated on its merits. Much will depend on the size of the lamp, the number of exposures made in a given time, and the length of the exposures you normally make.

If you are in the habit of stopping right down and giving long exposures you might well consider whether this is really necessary. Certainly a small stop will compensate for focusing errors but if you can focus correctly there is no point in using a smaller stop than is necessary to prevent the exposure being inconveniently short.

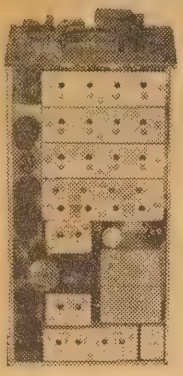
When you are making only one print from each negative, the exposure, normally measured in seconds, will be followed by several minutes of idleness while developing, etc., is in progress, and this is normally quite sufficient time for the lamphouse to cool. On the other hand, if you have a number of prints to be made from the one negative, you may adopt the procedure of making all the exposures first and following it up with a session in the developer. In this case a lamphouse which has been effectively light-sealed may run hotter than is desirable.

The real objection to excessive heat is, of course, the danger of damaging the negative. While there is little danger of actual fire, it is quite easy to cause severe buckling of the negative, or even have it stick to the carrier glasses. Where glassless carriers are used, buckling can easily throw the image badly out of focus and will call for better ventilation than the glass type. Dense negatives, in addition to requiring longer exposure, absorb more heat than thin ones and thus are doubly prone to heat damage.

In some designs a lot of light escapes around the negative carrier, again due to efforts to provide ventilation, and it is sometimes necessary to drape some opaque material around this part at least during exposure. Possible damage to the negative can be minimised by removing the carrier as soon as the exposure is complete.

Even when the lamphouse is completely light-tight, there is still another source of fogging. This is due to rays of light from the lens, particularly those representing the shadow areas, being reflected from the paper on to nearby walls, or even the operator's shirt, and back again on to parts of the paper which are otherwise receiving little or no light.

The remedy here is to either move the enlarger away from such surfaces or, when this is not possible, to paint them a flat black. If this treatment is carried well up the walls it will also reduce reflections of light escaping from the lamphouse. At the same time it is wrong to imagine that all



R.C.A. COMMUNICATIONS RECEIVERS, (MADE IN AMERICA)

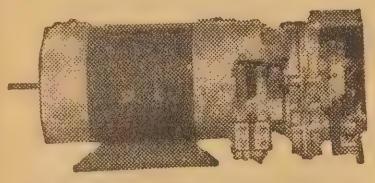
4 BAND 195 KC TO 9050 KC CONTINUOUS COVERAGE

£19-15-0 FREIGHT EXTRA

These receivers are designed for 24V D.C. operation but can be converted to operate from 12V or 32V D.C. or 240V A.C. with external power supply.

PHOTOSTAT OF CIRCUIT SUPPLIED WITH EACH RECEIVER.

Ideal for car or boat installation. Dimensions 8½" x 7" x 16" deep.



TYPE "A"

IFF MOTORS

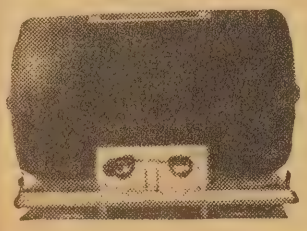
THE—MOTOR—WITH—A THOUSAND—USES

£2/5/-

Postage and Packing—N.S.W. 7/6. Interstate 12/6.

TYPE "B"

These motors are rated at 18 volts D.C. and develop 1/10th. H. P. but will operate on as low as 6 volts. Easily converted to operate on 240V A.C. as per R. & H. December, '49, or Hobbies Illustrated November, '50. Type "A" is fitted with gear box giving speeds of 4200—150—25—or 4 R.P.M. Type "B" is fitted with gear box giving speeds of 4200—20—or 5 R.P.M. and is also fitted with blower which has many uses. Both types have extended spindles.



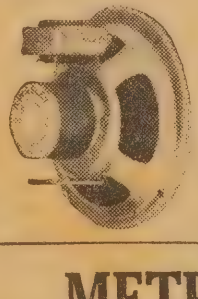
DEPENDABLE AMERICAN GENEMOTORS

H. T. SUPPLY FOR YOUR CAR SET, AMPLIFIER, &c.

TYPE "A" Input 12V at 4 amp. Output 225 volts at 120 ma.
TYPE "B" Input 6V at 6 amp. Output 200 volts at 60 ma.
Size 7" x 4". Weight 7lb. Input filter supplied free with each genemotor.

6 VOLT £3/10/- **12 VOLT £3/-/-**

Postage and Packing N.S.W. 6/-, Interstate 8/6



NEW KINGSLEY SPEAKERS

5 inch per-mag. complete with 10,000 ohm transformer

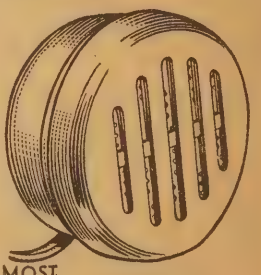
22/6

Postage 2/6 extra.

PILLO-FONE

EXTENSION-UNIT

IT'S A REAL MINIATURE WITH ROLA UNIT



Instal it anywhere, in the sickroom, workshop, garage or any room in the house. Just connect across voice. coil of the existing speaker.

THE "PILLO-FONE" IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED.

22/6

3½" Diameter by 1¾" deep. POST FREE.

SPECIAL!

CARBON RESISTORS

Well-known make of carbon resistors in values of 100 ohms to 250,000 ohms. In 1-watt, ½-watt and 1-3-watt. All resistors are standard color coded and in original cartons.

In lots of 100, mixed values comprising 50 1-watt, 25 ½-watt, 25 1/3-watt. Post free.

IN LOTS OF 500, 50/-. **12/6**

METROPOLITAN RADIO SUPPLIES

479 PARRAMATTA RD., LEICHHARDT. PHONE LM3610.

AT TOP OF TAVERNER'S HILL.

the walls of a darkroom should be painted black. On the contrary, much more efficient lighting is possible for a given degree of safety if a light color is chosen so that the safelight illumination will be reflected into all parts of the room.

To minimise light reflected from the base board it is essential to mask the negative so that the only part projected is that to be actually printed. In particular avoid projecting blank areas around the edge of the negative as these can quite easily pass many times the amount of light passed by the negative.

NEGATIVE MASKING

Another source of reflection, though not quite so serious, is the paper holder. While some workers simply anchor the four corners of a sheet with drawing pins and trim the edges later, most workers like the idea of a white border around the print.

Commercial paper holders provide this facility as well as holding the paper flat. Most of them have fixed masks on two sides which automatically mask the paper for about a quarter of an inch when it is pushed against fixed stops, while adjustable masks on the other two sides may be set to give the same size border on whatever sized sheet of paper is being used.

All this works out very well except for the fixed masks. These are usually of rectangular metal and thus present a flat surface, about a quarter of an inch high, at right angles to the surface of the paper. Light rays from the lens, intended to be masked, strike these surfaces and are reflected from them on to the surface of the paper. This results in a narrow area of fogging in the form of a dark streak near the two edges of the print and can completely spoil an otherwise good print. Even when the masks are painted black there can still be sufficient reflection to be serious.

MASK REFLECTION

This effect can be eliminated if the negative is carefully masked on these two sides so that there are no unwanted rays to strike the reflecting surfaces. The masking is not so critical on the other two sides since the adjustable masks are usually of flat metal and present no surfaces which can reflect on to the paper.

Have you been troubled by finger prints appearing around the edge of your prints? While interesting perhaps to the criminologist they do not enhance the appearance of a print and many a good picture has had to be re-made on this score. The cause is either chemicals or perspiration on the fingers which is transferred to the surface of the paper during handling, generally prior to development.

There are two ways in which they can be minimised, first, you should adopt the technique of handling papers by the back and edges only and, secondly, by carefully drying the hands before handling papers.

The first habit is not a difficult one to get into and once acquired will be followed automatically. A small towel should be kept handy for drying the hands, but don't use one of the regular household stock or you'll be in real trouble. The stains are almost impossible to remove by ordinary methods.

As well as the printing paper, there is always the possibility of contaminating one bath from another by transferring the chemical on the fingers. The most serious risk is that of contaminating the developer with the fixing bath, which is usually disastrous since the fixer is designed to neutralise the developer. It is a good idea, therefore, to avoid putting the fingers in the fixing bath at all, using a print paddle or a pair of print forceps to handle the prints in this bath and confining your handling of the prints to the developing bath.

Is your safelight really safe?

If you only think it is it is time you made sure, for unsuspected fogging from this source can quickly kill the sparkle in your highlights. Testing is a simple operation, involving only a few minutes work and a small piece of bromide paper.

By the light of a known safelight, such as the one you use for films, cut off a small piece of paper and place it on your bench in your usual working position. Cover part of it with some opaque object, such as a penny, and then turn on your safelight for about three minutes. The actual time will depend to some extent on your working speed but it would be unwise to give it less than this.

CHECKING SAFELIGHT

Now develop in the normal way, fix, and examine carefully by white light. Unless it is impossible to detect which part of the paper was covered you cannot consider your light safe, and adjustments should be made until it can pass this test. On the other hand, there is no point in working with less light than is safe, and a light which can pass this test may only be safe because it is inefficient. If this is suspected it may be worth while conducting some experiments with the placing and brilliance of it until tests indicate that it is approaching an unsafe condition.

The first time you open a packet of other than glossy paper you may be at a loss to determine which is the correct side of the paper. Except in the case of very rough surfaces there is usually quite a distinct difference between the emulsion surface and the paper, although it is by no means as definite as a glossy surface. More careful examination is usually necessary but it should not require the paper to be brought unduly close to the light.

The natural curl of the paper is normally toward the emulsion but, on odd occasions, you may find that the packing is such that an individual sheet is curled the other way Most makers adopt a particular system of packing and adhere to it, so that it is a good idea to familiarise yourself with the method used by your particular maker.

Some workers advise biting the corner of a sheet of paper, explaining that the emulsion will stick to the teeth more readily than will the paper. This is a rather drastic technique which, so far, the writer has not found necessary.

Most papers are packed in some form of waxed paper, then placed in an opaque black envelope and, finally, in the regular outer envelope. Unless required as a protection against extremely humid conditions the waxed paper can be discarded and the papers retained loose in the black envelope. As a precaution against light leaks the writer has acquired the habit of replacing this in the outer envelope with the open end to the bottom, thus making necessary a very definite procedure before the black envelope can be opened.

A better idea, and one which I shall probably get around to one of these days, is that of a light tight drawer or box in which papers may be kept loose. Ideally, this should be equipped with a set of contacts which, preferably through a relay circuit, will open the white light circuit whenever any attempt is made to open it. Such a device not only protects paper stocks from accidental fogging but also cuts down time by eliminating the opening and closing of packages.

SEPARATE SWITCH

In any case, it is a good idea to have the white light switch located away from all other switches so that there is less chance of turning it on in mistake for, say, a safelight switch, while sensitive material is exposed. Alternatively it may be of a distinctive type, such as rotary instead of tumbler, or recessed as in the case of industrial "safety" switches.

Another switch worthy of consideration is the enlarger switch. This needs to be so mounted that the operation of it will not jar the enlarger and cause image shake. At the same time it needs to be conveniently placed so that one may turn one's attention quickly to any shading or dodging which the projected image may require.

One method is to mount the switch on the wall near the enlarger, another to use a cord type switch on the end of a length of flex (these switches are not readily available on the Australian market) while one of the most popular schemes is some form of foot switch. The best design for these seems to be one where a fairly long bar is available for foot pressure, thus avoiding the annoyance of searching for small button device which is never where you think it is going to be.

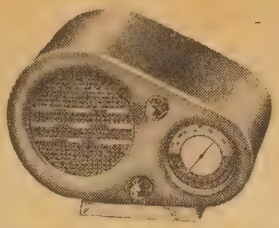
Accurate focusing is essential if the print is to be really sharp but this is not always easy when the negative is unusually dense. The position is further aggravated by the need to project such an image at, or near, full aperture if the exposure is not to be inconveniently long with consequent risk of damage to the negative.

FOCUSING NEGATIVE

In cases like this it is better to focus with the aid of a more suitable negative, preferably a focusing negative specially designed for the job. These can be purchased ready made or you can make one for yourself. One method is to take a spoiled negative and score a number of lines on it with a needle, the fine irregularities of the edges providing an excellent pattern to judge sharpness.

An alternative scheme, which is a good one if you have the facilities to do it, is to photograph some fine detail, such as printed matter, on a contrasting emulsion. Such a negative is excellent for focusing, as one can concentrate on an individual figure or letter and adjust for the sharpest possible result.

A magnifying glass is also of considerable help when focusing, providing a more critical view of the



MANTEL CABINET

This beautiful little cabinet measures only 9 inches long x 6½ inches high x 5 inches deep. It is suitable for a four-valve set and will take a 3 or 5-inch Speaker. Finished in Blue, Green or Cream Lacquer, these are modern and attractive.
Complete with suitable Chassis for 4-valve Receiver.

Price only 35/-.

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A real bargain for

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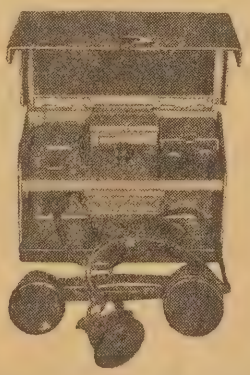

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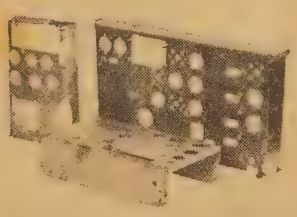

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Drilled, all at one price. Send the dimensions, you require and we will forward the nearest we have.

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(Illustrated)

These Coils as used in Aircraft Magnetos consist of a primary and a secondary wound on laminated iron core. A mica condenser is fitted across the primary. Suitable for experimental work may be adaptable for HT Oscilloscope supply, etc.

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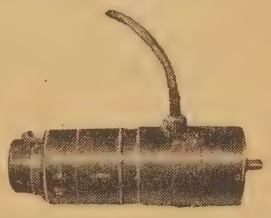

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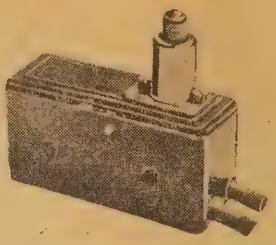
These Motors operate off a 24-volt supply, and are geared down to operate aeroplane cowls, etc., have automatic braking device, particularly suitable for beam signals, aerials, etc. They are very powerful but light in weight.

Price £4/19/6.

Notice . . .

All parcels sent registered post unless otherwise stated.

Postage on Freight must be included with order.



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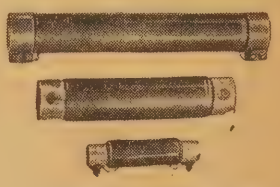
As illustrated in perfect condition. Makes 2 circuits, breaks one. A.C. Rating 10 amp-125 volt. 5 amps-250 volts, 3 amps-460 volts, 2 amps-600 volts.



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Available in the following sizes:

Resistance	Wattage	Price
20	20	2/6
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100	40	4/-
250	20	2/6
300	85	5/-
350	25	2/6
450	10	2/6
500	27	2/6
500	55	4/-
600	40	4/-
700	20	2/6
1000	120	5/-
2500	85	5/-
3000	25	2/6
3700	30	2/6
4000	20	2/6
5000	55	4/-
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Also available 20 watt Wire Wound Resistors in the following sizes, priced at **2/- each.**

50, 75, 100, 125, 150, 175, 200, 250, 300, 400, 500, 750, 1250, 1750, 4000, 7500, 12,500. 15,000, 17,500.

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EXTRA SPECIAL

Famous G.12 Speakers. Brand new in perfect condition. Today's value £16/19/-.

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image than is likely to be given the finished print. A fairly long focal length is desirable, otherwise the glass will have to be placed in the beam to bring it into focus. You will probably get away with a length of six inches but a longer one would be desirable.

How do you place your paper in the developer?

It is important that the developer flow evenly over the surface of the print otherwise uneven development may occur. Best method seems to be to tilt the tray so that the solution is at the far end, place the end of the paper in the solution, then lower the front of the tray so that the solution flows forward over the paper. Any air bubbles should be immediately removed with the finger—which is just another reason why it should be free from contamination.

FIXING

Fixing of enlargements does not differ greatly from the fixing of contact prints, but it must be realised that much greater areas of emulsion are involved and the amount of fixing bath should be increased accordingly. While various fixing baths vary in their useful life in terms of print area, it is usual to allow about 60 8 x 10 prints per gallon if no stop bath is used, but assuming a brief water rinse after development. Where a stop bath is used the number of prints may be approximately doubled, since this neutralises the developer and takes a considerable load off the fixing bath.

If this is not used the fixer should most certainly contain an acid hardening solution to neutralise the developer and toughen the emulsion. It is advisable to move the prints around smartly when they are first placed in the fixer, otherwise stains may result and, to ensure efficient fixation, they should also be moved around from time to time while in the bath and not allowed to collect in one pile.

Do not leave prints in the bath for long periods. Although the time is not exactly critical, prolonged fixation can result in severe fading of the image and every effort should be made to remove each print not later than 10 minutes after it is placed in a fresh bath.

DRYING FLAT

Glossy prints, when dried on a glazing plate, should be free from buckle and have only a slight curl. Matte papers, on the other hand, if allowed to dry naturally will have a pronounced curl and buckle. Prolonged pressing under a moderate weight, such as a book, will eventually flatten them, but it is a lengthy process. Quicker results can be obtained by damping the back of the print before pressing it and it will then dry flat.

A variation of this is to put the print under pressure before it is quite dry, but it is essential that the face of the print be dry before this is attempted, otherwise there is the danger of it sticking to the surface against which it is pressed.

If you should be unfortunate enough to spill developer on good clothing make every effort to wash the garment immediately. If this is not possible or the accident is not discovered until too late, you will find that it has left a brown stain which cannot be removed by washing or dry cleaning. However, the following method is usually successful. First soak the stained portions in a weak solution of potassium permanganate, but be careful that it is not too strong or the cloth may be damaged. A strong pink color which is still transparent is about correct and the solution should be free of undissolved particles.

STAINS

The permanganate solution will stain the cloth but at the same time it will attack the original stain. The permanganate stain is now removed by placing in a 10 pc solution of potassium metebisulphite. This is made by dissolving one ounce of chemical in about eight fluid ounces of water and then making up to 10 ounces, but the proportion is not particularly critical. If the original stain is not completely removed repeat the procedure from the beginning after first washing the potassium metebisulphite out of the cloth.

If this is not done it will neutralise the permanganate solution and you will have to prepare a fresh mixture. As well as clothing, this process is useful for clearing the handsod developer stain.

Rapid Control of Fires

OIL fires that usually rage for hours before they can be checked are now brought under control in a few minutes or even seconds. This is done by a new process devised by safety engineers of the Vacuum Oil Company.

The method consists of agitating the oil by injecting air at low pressure into the lower areas of the tank. This brings cooler oil from these areas to the surface in waves that spread over the burning area, cutting down the vapors on which the flames feed.

No intricate or costly devices are required. Air is pumped in through pipes that are already built into the tank for other uses. Readily available air and a pump that produces about six pounds pressure per square inch are all that are needed.

In recent tests at the company's refinery in Olean, New York, 100,000 gallons of flaming kerosene in a large tank were extinguished in 5 seconds. In another tank, blazing crude oil was brought under control in 45 seconds and the fire was then put out by firemen applying foam at close range.

Used only on fires in storage tanks, the new method is expected to be effective in oil tankers.

SHORT WAVE NOTES BY RAY SIMPSON

HIGHER FREQUENCY BANDS ON WAY OUT

Each year the Engineering Department of the British Broadcasting Corporation give their forecast regarding what can be expected in the way of reception during the ensuing twelve months. Their report for this year has just been published in "London Calling" and, as it will be of interest to all listeners, we are reprinting some of the most interesting excerpts.

WHEN London Calling last reviewed the changes in short wave transmitting and receiving conditions—in the issue for January 4, 1951—some rather remarkable events had recently taken place.

The sunspot activity, which since the middle of 1947 has been declining, had, during the latter part of 1950, undergone an abrnormally large and rapid fall, so that at the end of the year the wavelengths of use for short waves had altered considerably.

Since the connection between sunspot activity and short wave conditions may not be obvious to everyone, an explanation of their inter-relationship had better be given.

Short waves are only able to travel to great distances—they are only able to encircle the spherically-shaped earth — because they are reflected downward from the ionosphere, a region of electrified air lying in the high atmosphere.

"The ionosphere is produced, in so far as its reflecting properties toward radio waves are concerned, by the action of the sun, and hence its condition varies markedly with time of day and season of year. The short waves in use at any time have to be of such a frequency as will suit the ionospheric conditions, and thus the wavelengths must be changed from day to night, and from winter to summer.

The activity of the sun itself varies from a minimum to a maximum and back to a minimum again in a period of approximately 11 years and this too has an effect which must be taken into consideration. The state of the sun's activity is shown by the number and size of the sunspots which appear on it. These wax and wane over the average period of 11 years, and so, in the last resort, short wave conditions follow the well-known sunspot cycle.

At the end of 1950, as has been said, an abnormally large fall in sunspot activity was taking place, while in the last nine months of 1951 the average sunspot activity decreased, in fact, hardly at all, but remained more or less at a constant level. The minimum in the present sunspot cycle is not expected until early in 1955, and the sunpsot activity must undergo a further considerable decrease before that date.

During the summer 13 metres is likely to be of less utility as a daytime frequency for southerly directions, and may even fail over some circuits. The 16 metre band will continue to be well received over these circuits, but over transatlantic circuits even this may fail toward midsummer, though the 20-metre band should remain of use over all circuits.

At night, the 25-metre and 31-metre bands should remain good over the summer but, by next winter, the situation at night should be even more difficult than at present. Only the 49-metre band is likely to be of use over transatlantic circuits, with the 42-metre band usable over some other circuits.

Altogether, therefore, the lengthening of the optimum wavelengths which is likely to occur during the year can be well taken account of over most circuits at most times, but during next winter a longer wavelength than any now available for short wave broadcasting to North America would seem desirable at night.

INDONESIAN STATIONS

THROUGH the courtesy of the Universalite we show below a complete list of Indonesian short wave stations.

YDB 2.24 mc Djakarta.
YDG2 2.30 mc Surakarta.
YDL2 2.32 mc Padang, Sumatra.
YDI6 2.335 mc Djemver, Java.
YDW 2.35 mc Pontianak, Borneo.
YDG6 2.37 mc Madiun, Java.
YDN 2.38 mc Kutaradja, Sumatra.
YDA2 2.415 mc Bandoeng.
YDJ3 2.45 mc Jogjakarta.
YDH 2.50 mc Semarang.
YDD 2.60 mc Djakarta.
YDS 3.23 mc Menado, Celebes.
YDI 3.24 mc Sourabaya.
YDM 3.27 mc Bukittinggi, Sumatra.
YDG 3.33 mc Surakarta.
YDP2 3.35 mc Medam, Sumatra.
YDQ2 3.365 mc Makassar, Celebes.
YDA 3.39 mc Bandoeng.
YDH2 3.945 mc Semarang.
YDL 3.96 mc Padang, Sumatra.
YDU 4.84 mc Denpasar, Bali.
YDK 4.855 mc Palembang, Sumatra.
YDR 4.865 mc Ambon, Moluccas.
YDB2 4.91 mc Djakarta.
YDP 4.93 mc Medan, Sumatra.
YDA3 4.945 mc Bandoeng.
YDO 5.03 mc Bandermasin Bor.
YDJ 5.06 mc Jogjakarta.
YDF 6.045 mc Djakarta.
YDD3 6.17 mc Djakarta.
YDJ2 7.10 mc Jogjakarta.
YDF5 7.22 mc Djakarta.
YDB3 7.27 mc, Djakarta.
YDQ3 7.295 mc Makassar, Celebes.
YDQ 9.55 mc Makassar, Celebes.
YDF6 9.585 mc Djakarta.
YDE 11.77 mc Djakarta.
YDF2 11.785 mc Djakarta.
YDF3 11.795 mc Djakarta.
YDB4 15.145 mc Djakarta.
YDC 15.15 mc Djakarta.
YDF4 17.81 mc Djakarta.

SHORT Wave Notes for the May issue are due on April 5. For the June issue they are due on May 10. Please send them direct to Mr. Ray Simpsan, 80 Wilga Street, Concord West, NSW.

FLASHES FROM EVERYWHERE

HAITI.—Station 4VEH in Cap Haitien has been heard by many listeners in Australia also 4VRW in Port-au-Prince so here is another new one which is reported to be operating on 8.995 mc. The newcomer is 4VPL which is known as Radio Petiionville and is supposed to be on the air from around 7.0 am and close down about 1.0 pm. There has also been a report of this station in the 25-metre band on 11.755 mc. There is also a report on station 4VM which uses 6.012 mc and is known as Radio Philips. This station has recently sent a very attractive verification card to a listener in the USA.

SWEDEN.—In last month's issue we gave the present schedule of Radio Sweden as received from the station and according to letters we have received, many of these transmissions are being heard in this country. However, according to one of our Sydney correspondents, Mr. M. Randal, he is also hearing Sweden in their South American program on an additional frequency of 15.155 mc, opening at 9.0 pm. This channel was not listed by the station but is of course one of the old ones which uses the call letters SBT. It is not known whether the 15.155 mc transmission is from the old station located at Motala or from the new 100 kw one at Horby. There may be other changes so keep a lookout for anything new from this country.

LUXEMBOURGH.—Our regular and helpful correspondent in East St. Kilda, Mr. Alexander Talbert, once again comes forward with some interesting information regarding Radio Luxembourg. He recently received a letter from the station in answer to a report in which they write as follows: "Until recently we used to broadcast on 15.35 mc and 6.09 mc, but at present we are only operating on the latter frequency from 1100-1300 and from 1800-2400 GMT. Thee broadcasts Bonjour le Monde, Le Menage en Musique, Le passe-temps des Dames et des Demoiselles, and the transmission of Madame Tabouis, Les dernieres nouvelles de demain, are still on the air, but on long wave 232 kc. Our Flemish session takes place from 0530-0900 and from 1100-1300 GMT on medium wave 1439 kc."

AUSTRALIA.—There are a few changes in the transmission from Radio Australia, these being as follows: The British Isles and European transmission at present 0642-0845 GMT, will move back to 0745-0815 GMT, the frequencies to be used being 9.58 mc and 11.76 mc. Australian DX ers Calling will be presented on Sundays at 0700 GMT (5.00 pm EAST), and Listeners' Choice on Sundays at 0800 GMT. As from March 30, this transmission will be from 0600-0745 GMT on 9.58 mc (English); 0600-0645 on 11.76 mc (French); 0645-0745 GMT on 11.76 mc (English). The session Australian DX ers Calling remains as popular as ever and always has some interesting DX tips.

FRANCE.—An American listener writing to the Universalite gives some details regarding the frequencies being used by the French stations as taken from a verification he had just received. His letter was from Radio-difusion et Television Francaises, confirming reception of their relay station on 17.85 mc. The station is operated by the Services del' Explitation and the frequencies listed for Radio-difusion Francaise are now 5.955, 6.145, 6.2, 7.16, 7.24, 7.28, 9.55, 9.56, 9.615, 9.685, 9.755, 11.7, 11.845, 15.1, 15 24, 15.35, 15.4, 17.85 and 21.74 mc. These are the official frequencies said to be now in use and all English transmissions are

STATION ADDRESSES

ELBC—Liberian Broadcasting Company, Monrovia, Liberia.
Radio Africa—The Manager, Radio Africa, 2. Rue Jeannne d'Arc, Tangier.
4XB21—Direction Kol-Israel, Rue Melisande, PO Box 1082, Jerusalem, Israel.
ZO1—Radio Celyon, PO Box 582, Colombo, Ceylon.
YDC—Radio National Indonesia, PO Box 7, Djakarta, Indonesia.
BED7—Taiwan Broadcasting Station, Taipeh, Taiwan.
HI1A—Radio Caribe, Apartado 423, Santiago, Dominican Republic.
COBQ—La Voz de Cuba, Vista Alegre 269, Vivora, Habana, Cuba.
TGQA—La Voz de las Americas, Guatemala City, Guatemala.
XETT—La Hora Exacta, Dolores No. 17. 4/to Piso, Mexico D.F., Mexico.
HP5B—Radio Miramar, Apartado 910, Panama City, Panama.

THE HAM BANDS WITH BILL MOORE

NEED FOR EMERGENCY COMMUNICATION PLANS

Over a period of years amateur radio operators in various parts of the Commonwealth have assisted Shires in the operation and maintainence of radio equipment used in bush-fire fighting. In NSW delegates of the WIA attend Bush Fire Advisory Committee meetings, and in Victoria a further scheme is being introduced.

THE recent devastating bushfires which swept through many parts of New South Wales and Victoria showed that better communication facilities for fire fighting units would have assisted to ensure a full concentration of fighters at the most vulnerable points.

Ken Rankin, VK3KR, with this idea in mind, discussed the subject with the local police authorities in Benalla and, as a result, a public meeting was held on Monday, February 25th in Benalla to review bushfires problems generally.

The mayor of Benalla presided, and the 50 people present included Mr. Bostock, MHR, and other members, representatives of the Oxley shire and fire-fighting bodies, Reg Busch, VK3LS, the co-ordinator of the WIA's emergency organisation, VK3EP, VK3HP and VK3KR.

Among the matters discussed was the subject of amateur radio assistance on the communications problem, and it was generally recommend d that a base station be established in each major town, together with as many portable stations as practicable operating on the emergency frequencies 7002 and 3501 Kc/s.

At the conclusion of the meeting a demonstration was conducted by the radio amateurs present. Using VK3KR's home station as a base, Reg Busch, VK3LS, and Henry Fleming, VK3HP, provided the portable equipment used in the field.

The demonstration was very successful and clearly showed to an interested audience the possibilities of amateur operation available in most towns in any emergency.

As an outcome of the public meeting a special Bush Fire Emergency Communications Committee was formed, including all amateurs in Benalla VK3PF VK3ANW and VK3KR, and VK3JK of Wangaratta, and their main duties will be to implement the suggested scheme.

The amateur radio movement receives a tremendous boost from activities such as these, and at the moment the public service aspect of the hobby is better known than ever before.

Suitable public relations must assist in ensuring support in the future for any requests we as a body have to make.

VK/ZL JUBILEE CONTEST RESULTS

THE results of 1951 Jubilee VK/ZL DX contest showed that the contest was extremely well supported despite poor conditions.

The contest was supported by the Commonwealth of Australia as part of Jubilee celebrations, and was as usual organised by the Wireless Institute of Australia in association with the New Zealand Association of Radio Transmitters.

Over 580 logs were received by the contest committee, considerably more than ever before in the VK/ZL DX contest. Logs were divided as follows: CW section 335, telephony section 180, and 65 logs in the receiving section.

First place in the open CW section of the contest was filled by ZL1MB, who won top place in both Australia and New Zealand, using three bands 7, 14 and 28 MC/S amassed 25,575 points with 341 contacts. Second placegetter was ZL3OA with 24,346 points from 329 contacts.

Within the Commonwealth, first place was filled by VK2DG with 22,464 points for 234 contacts and second VK2AHA 16,800 points for 224 contacts.

Magnificent trophies were won by both ZL1MB and VK2DG.

The open telephony section was won by VK4KS with a score of 15,456 points, and second place was filled by VK2AHA with 9600 points. In New Zealand ZL1HY, 9447 points, was the winner and second, ZL1MQ, 5616 points.

VK4KS and ZL1HY won similar trophies to those presented to ZL1MB and VK2DG.

Eric Trebilcock, BERS-195 of Australia was an easy winner in the receiving section, totalling 14,070 points, Mr. O'Grady of New Zealand, filling second place with 8784 points.

From observations of the various competitors, some interesting points arise, points that can be considered before drafting the rules of future contests.

It would appear that a majority of competitors would be in favor of an operating period of 24 hours, during which all contestants would operate. This would eliminate the present uncertainty of selected periods of 24 hours duration, and place everyone on an equal footing.

Other points raised included the status of VK1 and VK9 stations, whether they should be included as Australian districts or DX.

OPERATION in W telephony allocation caused considerable QRM. The New Zealand stations are forced to work there but there seemed to be no need for the influx of VK's.

The hard work of the Jubilee Federal contest under the chairmanship of Wal Ryan, VK2T1, was undoubtedly responsible for the success of the contest and with the co-operation of national bodies throughout the world international publicity was complete. Information on the rules was forwarded to over 100 countries and stations from 58 different countries completed.

Leading scores were as follows:—

CW Open: VK2DG—22,464, VK2AHA—16,800, VK2ZC—13,090, VK6RU—11,523, VK5FH—10,505, VK5BO—10,050.

ZL1MB—25,575, ZL3OA—24 346. ZL1HY—11,696, ZL1MQ—9516, ZL1ADX—5952, ZL4GA—5895.

W6MVQ—5332, W7PGX—3375, W2WZ—2975.

VE7G1—360, KV4AA—1008, G4CP—901, G6XN—740. G2LB—560, GW3ZV—684, GW5SL—570, SP1JF—870, DL1DX—2205, ON4GU—440, YU1AG—256, OE1CD—372, OZ1W—350, SM5LL—456, DL7AA—1680, PAQUN—2121, OK1HI—325, EA4CN—310, FA8DA—312, VR2CG—7004. KH6IJ—2574, VX2EM—1060, VS7NG—1008, C3MY—720 FK8AL—910, YV5AE—729, VS6BJ—1235, JA2HB—1802, 4X4RE—957, VS1DZ—2912.

CW band scores — 7 mc: VK5JE—1000, VK2DG—925. VK2GW—846.

ZL3LL—1755, ZL30X—1480, ZL2ACV—1386.

14MC: VK3KX—10,615, VK5BO—9552, VK2DG—9348.

ZL1MB—10,560, ZL3OA—8400, ZL4AW—8216.

28 MC: VK6RU—990, VK2AHA—615, VK4KS—532.

ZL1HY—810, ZL1MB—630 ZL1MQ—630.

Telephony Open: VK4KS—15 456, VK2AHA—9600, VK3IG—6380. VK6RU—5586. VK6MK—4950 VK2DG—4512.

ZL1HY—9447, ZL1MQ—5616, ZL3OA—2205.

W6DI—2128, W8JIN—704, W7PUM—420.

VE7AIH—234, TI2OE—248, CE1AJ—168, G2DPZ—810, G2AJ—670, GM8MN—360, GW3FSP—238, PAQNU—115, F8OX—208, HB9LA—248, 3V8BB—189, VR2CG—3224, KH6IJ—3230, VS6BA—979, XZ2EM—1232, VS2BS—923, JA2MB—2970.

Telephony Band Scores.—14 MC: VK3LN—7686, VK4KS—5203, VK3IG—5040, ZL2GX—6048, XL1HY—4185, ZL1MQ—2627.

28 MC: VK4KS—2678, VK2AHA—960, VK5TS—840.

ZL1HY—855, ZL1MQ—465, ZL1KW—465.

Receiving Section: Australia, BERS—195—14,070. Mr. Bowden—4410, Mr. Burlinson—2952.

New Zealand: Mr. O'Grady—8784, Mr. Gray—7084, Mr. Kan—3842.

W.I.A. NEWS

Excellent conditions were experienced on the 3.5 Mc band during the first weekend of the CW portion of the W/VE DX contest in March. These made up to some extent for the erratic ones experienced on 14 Mc. Contacts with W and VE stations were numerous from 1800 hours EAST onwards, VK2VN working 30 W and VE stations in 90 minutes on 3.5 Mc during the Sunday evening. Other stations, too, amassed good totals and although the Americans were not extremely loud more were contacted than ever before. LU3EL was audible at 1815 hours.

On the previous weekend Ray Carter, VK2HC, was in contact with W7MSB for over two hours, signals S8 both ways.

Some DX calls will be evident at the North Coast (NSW) convention to be held at Urunga over Easter. VR2BJ, VRID, ZL2BT and possibly W6AL will be in attendance. Organiser Crieff Rettallick, VK2XO, reminds everyone to bring along their 144 Mc equipment for the hidden transmitter search, he reports that VK2AHA and VK2ZC of the Hunter branch are in training for the event, while VK2AGD's receiver is still on the secret list. If you find it possible to make Urunga at the last moment, contact Crieff, VK2XO, or zone officer, Noel Hanson, VK2AHH, and they can advise you about accommodation.

Newly-appointed Federal councillor for the NSW division is Vaughan Wilson, VK2VW, well-known WIA official. Vaughan will represent the division at the Federal convention to be held in Sydney at Easter. Retiring Federal councillor John Moyle, VK2JU, will act as observer for the division.

MOBILE POWER!

American stations are certainly taking their mobile operating seriously these days, and are gradually lifting their power to high levels. Most of the higher power operation is restricted to the 3.5 Mc telephony allocation, and many stations are running 400 and 500 watts input, while a few have run up to a KW. A popular final is push-pull 813's with 800 watts input. Power is generally obtained from a 24 volt 50 amp aircraft battery floating across a 28 volt 125 amp surplus generator coupled to the car engine. The main problem encountered to date has been to effectively deal with such power in whip antennas. Corona effects have been causing distortion and these have been cured by using parallel whips and brass balls on the top of the antennas. Clamp modulation is generally used, one station even using 4—250A's in the final amplifier Good contacts have been made using these transmitters from the west to east coast and across to Hawaii.

At the February meeting of the NSW division WIA a demonstration of "Minifone" transmitting and receiving equipment manufactured by the Commonwealth Electronics Pty. Ltd. was presented.

Mr. Bob Zuker assisted by Mr. Israelski, described the equipment, and demon-

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PRISMATIC TELESCOPIC SIGHTS

Can be converted for use as rifle sight, surveyors' sighting telescope and many other uses where first-class lenses are required. Length 5¾in. Eye-piece lens 1in, front lens ¾in, eye relief 3in. Weight 15oz.

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With this Tank Whip Aerial, the handy man can make a flexible fishing rod equal to the expensive type used by keen amateur fishermen. Comprising two 4ft tubular sections of tempered spring steel, fitting snugly into each other, it is a simple matter to construct a first-class rod. Weight 10oz.

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Type 1143 English equivalent to the SCR 522. Range 110 to 130 m/cs. PRICE **£12/10/-**

Type T.B.X. American Transmitter 2000 to 4523 Kcs. Receiver 8000 Kcs. Complete with Hand Generator, Headphones, Mike, Key, 2 Crystals, large and small Antennae, Aerial Wire (reel) 6 Valves, and very comprehensive instruction book.

All parts packed in strong webbing carrying bags. Complete unit in large transit trunk measuring 4ft x 16in x 16in. Maximum power output, 9 watts.

PRICE **£25**

No. 11 POWER PACKS. 11 volt 2.5 amp input; 210 volt .05 amp output. Complete with filters. AN IDEAL POWER SUPPLY FOR CAR RADIOS.

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A.S.B. 4 Power Packs £4

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Ideal for night shooting, 5" reflector, twin handle grips and trigger switch, both 12 and 24 volt available. All in "A1" condition.

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An Accurate and high class instrument having two thermometers with calibrated Fahrenheit reading scales.

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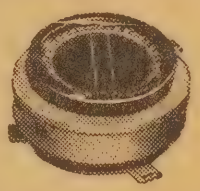
Telephone Handsets

STANDARD P.M.G. TYPE

PRICE 39/6

Postage and Packing: Vic. 2/-; NSW, SA, Tas. 3/-; Qld. WA, 3/9.

Compass Type P4



7in diam. x 3¾in deep, liquid filled, spring mounted. Navigational Compass. Reconditioned as new. Price .. **£4/10/-**

Postage: Vic, 3/9; Inter., 7/6.

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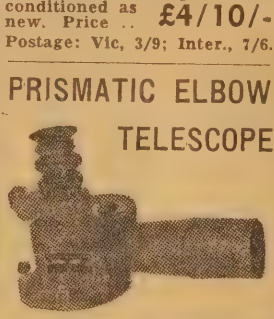

American make, with approx. X8 magnification, extra wide field and COMPLETE WITH COLOR FILTERS.

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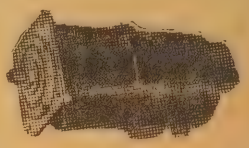

12 volt 500 watt	£5 0 0
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3½" V pulley to suit	£1 15 0
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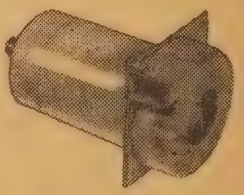
The above 24 volt models can be used as 32 volt without any alteration.



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Slowspeed Aircraft G111 Motor, 24V, containing 600 to 1 reduction gearbox and magnetic brake. Price **£3/19/6**

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English Lucas Spotlights. Ideal for Shooting, fit one to your car.

12 volt **25/-**

Fitted with mirror reflector.

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strated its operation by running one unit in Science House and another from various locations in the area.

Each unit, measuring approximately 12 x 8 x 6 inches, is complete with batteries and a collapsible ground plane antenna. Running 1 watt input on 80 Mc/s the sets are readily transportable, and provided amateurs attending with new ideas on portable operation.

After considerable discussion it was decided unanimously to instruct the Federal councillor to bring forward suggestions at the open business session of the Federal convention for the creation of two new classes of licences, technical and novice. These would be on similar lines to those in the US.

Qualifications required were the subject of much debate, and the main idea brought forward was toward greater occupation of our UHF bands.

THREE CLASSES

As a basis for discussion at the convention, the following requirements were supported: Novice class—Morse at five words per minute, elementary technical knowledge, and the usual AOCP standard for regulations. This licence would be valid for a limited period only.

Technical class—technical and regulations to full AOCP standards.

It was also suggested that operation be limited to the 50 Mc band and above. Country members were invited to comment on the ideas.

After discussion at the convention provided the various state divisions are in accord on the suggestions, the proposals will be presented to the PMG Department for their decision.

The ideas should certainly provide a subject for considerable discussion among amateurs.

In an endeavor to make the 3.5 and 14 Mc telephony allocations available in the future to amateurs without them passing the rather stringent requirements, 20 words per minute Morse and advanced technical knowledge of the amateur extra class licence, the ARRL have proposed to the FCC that the advanced class licence be still issued after 1952.

Present decision is to discontinue to issue advanced class licences (13 words per minute) at the end of the year.

The ARRL considers that the extended requirements of the extra class licence, are entirely out of proportion to the knowledge which ought to be required of an amateur desiring only the privileges of using telephony on these bands. They consider that some slight increase in the technical standard of knowledge of telephony operation for the advance class of licence would not be out of place.

It would appear that the main objection to the extra class privilege is that an increase of Morse speed is required for a purely telephony facility.

VK-5 EXHIBITION

THE South Australian division of the WIA is operating VK5WI from the Royal Adelaide Exhibition, and are giving excellent publicity to the amateur movement and the institute.

The station will be operating until May 3 on the following schedule: Mondays to Fridays, 7.30 to 10.30 pm EAST; Saturdays, 10.30 am to 1.30 pm, 2.30 to 5.30 pm, and 7.30 to 10.30 pm EAST.

Two transmitters will be in operation, the first covering the 7 and 14 MC bands and the second on 50 Mc/s. Antenna systems include a long wire on 7 Mc/s, two element rotary on 14 Mc/s, and four elements on 50 Mc/s. Three receivers and a pan-adaptor will be in use.

The exhibition committee, in view of the fact that the general public will be listening to contacts, have requested that, stations working VK5WI should make them as interesting as possible with a minimum of amateur jargon.

The following is the operating procedure suggested by the committee.

CQ will not be used by VK5WI, but will substitute the general call, "calling all amateur stations." Do not use the normal RST code for reporting, but state that VK5WI is "strong and perfectly readable" or other appropriate terms.

Technical matters should not be discussed but rather give general information on your location, weather and items of general interest.

VK5WI will be VFO controlled and answering procedure is as follows: Answer a general call on a frequency removed from VK5WI. The operator will tune the entire band in use, log all stations calling, and reply to each in turn. Stations when they hear their callsigns mentioned, should net on VK5WI's frequency, and be ready to operate when called in.

If you are crystal controlled, mention the fact when you are calling VK5WI so the operator can tune to your frequency.

It is also requested that stations keep clear of VK5WI's frequency while they are operating. As the committee points out, the whole success of the demonstration to the public depends on QRM free contacts.

The average din on our bands would not be a very impressive introduction to the public of our hobby.

The SA division and especially the exhibition committee under the chairmanship of Reg Harris, VK5RR, have worked hard to make the exhibit so successful. A little co-operation will ensure its full value being attained.

A special souvenir QSL card has been printed by the South Australian Government Tourist Bureau, and all contacts will receive cards. If you forward your QSL to VK5WI, c/o Chamber of Manufactures, Showgrounds Wayville, SA, it will be displayed at the operating booth.

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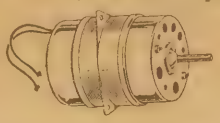

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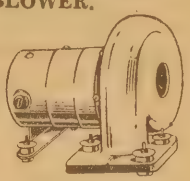

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1200 lb. per sq. in.

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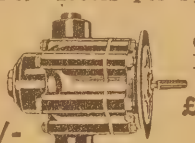

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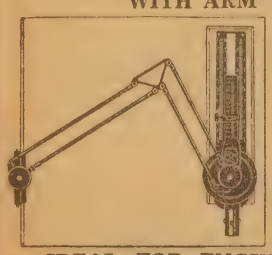

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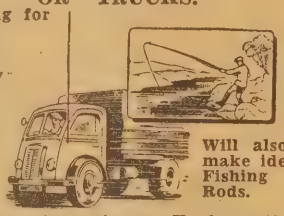

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12ft long. 3 sections. Each section 4ft 25/-. 8ft long, 2 section 15/-.

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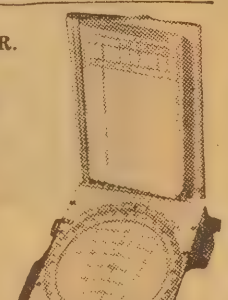

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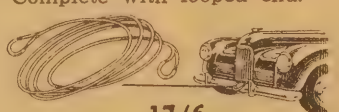

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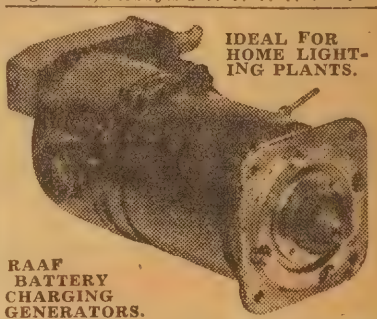

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12-volt, 500-watt in good working order, £5/5/-
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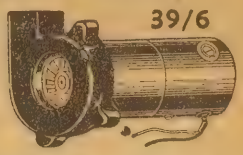

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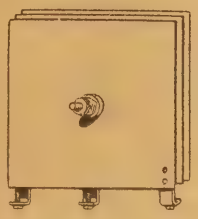

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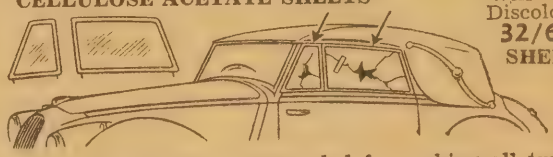

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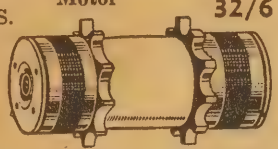

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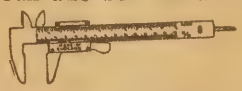

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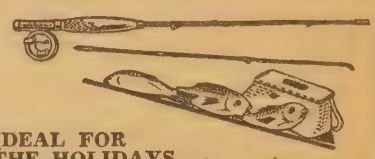

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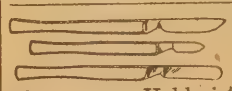

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OFF THE RECORD — NEWS & REVIEWS

Out of the blue has come the governmental edict that overseas exports are to be cut by 80 pc. Among the items affected are phonograph records and probaby many of the things that go to make phonograph records. That edict is bound to have a big effect on the record trade.

BY JOHN MOYLE

THESE notes are of necessity written a week or two before you will read them, and it is too early yet to appreciate the full implications of the import restrictions. But the record people and the public are most unhappy about them.

At the present time, virtually all EMI records, other than popular music and a few mid-brows, are imported from England. These include labels by HMV, Parlophone, Columbia and Decca. There are now quite a few independent record companies pressing discs out here, but they are nearly all concerned with popular stuff. Some have made a stab at microgroove, but so far only in a small way.

It follows, therefore, that the import cut will in the first place apply severely to non-popular records. Classical works on 78 are likely to become very scarce if we are to rely upon imports.

An even more disturbing blow lies in the fact that other items essential to record manufacture will probably be affected. You can't make many records if you can't import matrices, tapes, and raw materials.

I would repeat that at the time of writing it is not clear to what degree the record industry will be affected by these happenings. We may be sure that every avenue will be examined to find a way out of what would appear to be a very tight corner. Tighter, possibly, than any which has so far faced the record industry.

It is impossible at present to say how the stock position, either in finished records or in recordings not yet released, will help out. It's not likely to be of much assistance if the present cut persists for a period.

By far the most distressing feature of an unhappy business is the possible removal, or virtual removal, of microgroove records just when they had began to make headway. This, I think, will be a big blow to us all. I feel sure that the LP record had gained an unshakable foothold in Australia, and taken big strides toward its inevitable future as the backbone of broadcast recorde music. It looks as though no furthe advances can be made once the effec of the severe cut is felt.

It is extremely difficult to thin up any way in which Decca can con tinue to supply records if they can be imported. In this regard, the must be lumped with the 78's whe posing the question—if they can come from England, can they b pressed here?

Frankly, at the time of writing just don't know, and I'm sure th record people don't either. It woul mean an almost complete reversa of EMI's policy which, at the mo meit, is to press only popular records either imported or local in origin And available presses are hard a work to keep up with the job allo cated to them.

EMI POLICY

Even if this matter were adjusted the recordings themselves an materials to make the discs, must b obtained in much greater quantity.

We can be sure that these an other matters will cause some fas and furious thinking in the nex week or two, and I sincerely hope that some way out can be found which will cushion a terrific blow to the industry. Maybe by next month's issue the position will be much clearer, and the outlook not as gloomy as it is now.

But it's hard to be optimistic about microgrooves. Even if EMI are able to arrange for increased pressings to be made here, it is doubtful whether they will find facilities for pressing microgrooves. It is hard to imagine the idea fitting in with EMI policy, which is still to keep away from LP's.

This position can't be expected to maintain for long, however. If the unpredictable EMI doesn't make a move pretty soon, it may find a new race of stars have taken the opportunity to rise, and the LP field may not be so easy to crash at a late hour.

The smaller record firms might find themselves more favorably placed in some ways if they can manage to keep up their flow of raw materials. But this reaction is not likely to extend seriously to the classical music field. Not only are first grade performers virtually nonexistent, but recording standards are below those required for first quality records.

Altogether, friends, I'm pretty gloomy right now. Maybe I will be able to work up a more cheerful expression next month. Here's hoping!

I don't think there is much doubt that the severe restrictions just announced will be lifted eventually. When that time comes, it is likely that we will see a big change in the record position, with a considerable swing to the microgroove. We might even hope that EMI will have made

p its mind to chase its competitors ho, despite their sterling efforts, aven't altogether made up for the ict that their line-up of stars doesn't utshine that of EMI.

It may be rather significant that ie American Columbia firm—origintors of the LP record—have transerred their connection from EMI to hilips, and that this organisation is reparing for a world-wide distriution of the American recordings in ddition to their own.

Or there may be some connection ith the fact that EMI, having availble the RCA Victor library from S, can't handle the competitive olumbia at the same time. By clariying an otherwise confusing trading osition, the move may have helped ward the day when EMI will give eir promised six months' notice of icrogroove releases.

8 MICROGROOVE

Judging by some of the splendid ictor records I have heard lately ey should have some fine ammuniion to fire, even without American olumbia.

There is, for instance, Feste Romne, played by the NBC Orchestra nder Toscanini, a complete answer o those who imagine LP records aven't the same weight, mass, and mpact of the best 78's. There is no cratch or clicking with this disc. Records like this one merely bear vitness to the inevitable.

Philips also sell in Europe a 7in 8 record with a microgroove giving min. They may be ready for the ustralian market with standard and P records when the lid comes off gain in the future.

Incidentally, a reader reminds us hat Columbia and Parlophone labels ssued by the French EMI group apeared in France last year, 45 Engish Deccas and American RCA's also elling there.

It looks as though my impression f some months ago that speed isn't ow important is borne out by the ree mixture of 78, 45 and 33 records. ctually the number of firms which n the last year or two have added eir names to those we know all ver the world is now too large to eep track of. Lack of high-grade erformers seems to be their main tumbling block.

RECORD CLEANING

Incidentally those interested in narketing bottles of record-cleaning olutions might have a good talking oint if we are obliged to look to our resent record stocks for entertainment for some time to come. We ertainly would be wise to look after what we have.

I have had an opportunity of trying Clendisc and Dustex during the last few weeks, and have found that, whatever they may or may not do, they at least do clean records. I have persevered mainly with Clendisc, an English preparation (which probably must now be made here) distributed by EMI Sales and Service on behalf of Remington, Van Wyck Ltd., of London.

I've found this stuff most effective for removing fingerprints and greasy marks from records. It does appear also to reduce the tendency for discs to acquire electrostatic charges which, of course, attract the dust.

It seems to be quite safe for microgroove records upon which I have been a bit chary of using any solutions. The claim that it removes clicks which are heard on some LP's is probably justified as a result of the dirt removed by the solution. It would appear, however, that my LP records haven't collected enough dust to have become "clicky," for I couldn't honestly detect any improvement with those I have suffering from this trouble.

The few clicks which do worry me are no doubt due to processing faults or to minute scratches, and no cleaning solution seems likely to improve them. As I didn't feel like deliberately messing up a disc as an experiment, I'm happy to take the maker's word on this point.

I don't think there is much doubt that some LP discs are worse than others in this regard, although only one or two of those I have heard to date would I class as really annoying. I think this is because my pickup is relatively free from peaks, and because my amplifier uses the full amount of de-emphasis demanded by LP records. The situation is not so good, for instance, when using some crystal pickups which have a constitutional peak by no means easy to eliminate, and a curve which doesn't take so kindly to the standard de-emphasis.

Possible "clickiness" is probably tied up with such things as wear on the stampers, too. I have noticed that early pressings of some discs have been better than later copies, something which is not confined to LP records. It may be that pre-emphasis, and complementary de-emphasis, will be increased in the future for LP records to help combat this. Its remarkable what a few extra db can do in keeping down back-ground noises, although naturally there are limits.

SLOWER SPEEDS

Record cleaning solutions are in any case much preferable to the record-cleaning pads, which have been sold for years. These are a menace on LP records. Not only do they collect dust themselves, but they are just about the best things to charge the discs electrostatically, thus making the dust cling more tenaciously than ever.

I am often asked whether I've heard any more about the extremely slow speeds for records which were mentioned some little time ago.

In reply, I would say that the only extra speed I know of which has gained any ground at all is 16 rpm with a standard microgroove, and that only for recordings where high quality is not required. There are many records made for various purposes not calling for wide range and extremely low distortion so much as uninterrupted playing for a long period. I would be surprised if anything were to shake the 45 and 33 speeds for a long time to come, with the 78 dying steadily of old age.

One variant from these types which might serve as a useful stop-gap is the Variable Micrograde. This is a 78 type record made with a standard groove but with variable groove spacing which extends the playing time to about double the normal time. It can thus be placed straight on an ordinary turntable and played with an ordinary pickup.

Fred Falk has some of these records, and I am looking forward to playing some of them. No doubt the new import restrictions will eventually send these off the market, as well as the range of Polydor records, both standard and LP, which Fred has for sale.

LET'S BUY AN ARGUMENT

(Continued from Page 87)

broad-band IF channel look mc attractive as an ultimate solution.

(4) Overcoupling can make a sta dard 455 Kc. tuner roughly equivale to a TRF but with better "ski separation. Whether this could extended, however, to include up 9 Kc. sidebands and still be simp to duplicate and align in the ho is problematical.

The idea which looks better to m the more I think about it, is th of a superhet tuner using a 1900 K IF channel and only two slight overcoupled transformers. Oscillat tracking might be a problem b we'll see!

Someone might remind me th there has already been on t market (and gone) a kit for a 19 Kc. superhet, using two I.F. stag and a permeability front end. Tru but those special features may ha been its downfall. With one I. stage and conventional tuning, might be a very different story.

Then again, it might be said th variable coupling 455 Kc. transfor ers with tertiary windings have lik wise been available but not wide used. Maybe people don't want va able selectivity as much as a simp 100 pc wide band job? Maybe th don't like tertiary windings?

It could even be that both schem came before their time. Maybe t time's ripe now?

STILL MORE CONCLUSION

By way of conclusion, I imagi that some of you may want to veri what I have said—or disprove it—b carrying out your own tests. If s you'll need to watch a few points.

Make sure that the modulation pe centage of your generator is he constant, irrespective of frequenc It isn't just enough to feed an aud source into a generator and hop for the best. Where instrumen are not available, you can get equ valent results with the help of th ABC tests and a voltmeter acro the output circuit.

Be careful to tune the receive accurately with a low modulatin frequency (say, 400 cps), and leav the tuning untouched thereafter a you increase the modulation fre quency. You can always get mor output by deliberately tuning to th high frequency sidebands but this cheating. You don't deliberately mis tune an AM receiver for ordinar listening, unless you are fond of dis tortion!

Before doing any tests at all, alig the receiver carefully on a wea carrier. It is mortifying to spen a lot of time taking figures, onl to find that one of the circuits wa off resonance all the time.

Finally, do all your response test with a fairly strong input signa typical of those you will normall listen to. Slight regeneration, pre sent under weak signal condition and "Miller effect" on strong signal both modify the response to som extent. You will get all kinds c inconsistent results unless you ar awake to the possibilities and allo for them.

ANSWERS TO CORRESPONDENTS

G.L. (Waverley, NSW) is interested in building the Playmaster No. 1 amplifier and would like to know how it compares with the 807 Radiogram. He also has something to say about the high price of radio cabinets and suggests we might publish some constructional details.

A. We assume that you are referring to the 1947 Senior Radiogram in which case the main difference would be the use of voice coil feedback and the addition of the control unit. The first feature helps to eliminate some frequency losses in the output transformer, while the second one is really essential if a lightweight pickup is to be used and also if various recording characteristics are to be correctly compensated. We agree that the price of cabinets is high but we are afraid that it is just another indication of the conditions which put most commodities in the same category. We have considered the idea of cabinet designs and may yet do something along the lines you suggest. However there are quite a number of difficulties to be overcome and it may not be practicable.

H.N. (Christchurch, NZ) tells of the success he has had with a portable which he changed from an untuned RF stage to tuned stage. He also gives some details about capacitive top coupling of coils to improve high frequency sensitivity.

A. Your results are very interesting and help to demonstrate most forcibly the value of the tuned RF stage. The fact that the extra tuned circuit can be separately adjusted is not quite the advantage that it may appear for, in a correctly adjusted and tracking circuit, exactly the same operating conditions would apply. The idea of capacitive top coupling is quite a good one although it cannot be indiscriminately applied. Many coils, if not all, are now being fitted with this coupling as standard. Usually a single loop of plastic hook-up wire around the winding is all that is necessary. If the idea is carried too far it can result in undesirable effects such as tracking troubles, &c.

J.S. (Clayton, Vic.) says he appreciates particularly the "Let's Buy An Argument" feature and wants us to clear up a matter relating to primary colors.

A. Many thanks for your letter J.S. To use a cliche "we'll do that small thing" at the first opportunity.

C.G. (Coburg, Vic.) says he has appreciated the contents of Radio & Hobbies since its inception and likes particularly the "Reader Built It" and the "Shortwave Notes."

A. Thanks for your letter C.G. and for your encouraging remarks. Your offer of surplus parts to any young enthusiast is much appreciated and we have arranged for an appropriate panel to appear in the "Answer Tom" section.

E.H.J. (Adelaide, SA) sends us a circuit for possible inclusion in the Reader Built It page.

A. Many thanks for your letter E.H.J., and your description of the receiver and circuit diagram. We have passed this on to the "Reader Built It" section for possible inclusion in the magazine at a later date.

W.A.K. (Yannathan, Vic.) wants to know if we have any details of a set using a regenerative loop aerial, and suggests that the type of coil is known as a spider web and that the regeneration is controlled by moving the two with relation to each other.

A. The general idea is quite sound W.A.K., but the type of regeneration control you mention is hardly ever used these days, the mechanical limitations being considerable and control with a variable condenser or resistor in some other part of the circuit is much to be preferred. A set along these lines was described in R & H for February, 1947, under the name of "Tex" and the circuit with other data, including the coil winding details, is available through our 2/- query service.

A.W.M. (Noble Park, Vic.) suggests that we warn readers against using ordinary adhesive tapes for splicing magnetic recording tape, since it tends to slide and lose its grip. He recommends splicing cement.

A.: We agree that ordinary tape should not be used except as an emergency. The adhesive may easily affect the next layer on the reel and pull off the magnetic coating. The proper "splicing" tape which is sold for the job does not appear to suffer this limitation nor, as far as we gather from those who use it, does it tend to slip as you suggest. The same folk are wary of the splicing cement as it appears to harden some tapes and produce a spot which will not flow evenly around curved magnetic faces. Other tapes are not so affected.

L.M. (Surrey, England) sends his subscription to Radio and Hobbies and expresses appreciation of the current "Playmaster" amplifier series. He would like to see every amplifier presented in conjunction with a full wiring diagram.

A.: Many thanks for your letter, L.M., and for your appreciative remarks. We do not mind producing wiring diagrams for the simpler units but the job of preparing one for a large receiver or amplifier is very difficult and we simply don't have the time to tackle it in many cases. A further point is that we do not want to encourage beginners to build large equipment before they are past the stage of relying on a wiring diagram only. The blueprints you speak of are chassis plans only, showing the positions of holes, &c. They do not assist in wiring the set.

A.C.N. (Yarraville, Vic.) sends us circuit and details of a signal-tracer to be passed on to the Serviceman Who Tells.

A.: Many thanks for your letter, A.C.N., and the trouble you have taken to draw the circuit and list the details. The information has been passed on to the Serviceman for possible inclusion and comment in a later article.

H.G.L. (Auckland, NZ) comments on the response curves of the Acos GP20 and details some of the experiments he is conducting with this type of pickup. He also wants to know if we can supply a compensating circuit to remove the unwanted peaks.

A.: Glad to hear that the curves were of some use to you, H.G.L. but we are sorry to say that the compensation network is not quite so easy. We carried out some experiments along these lines, using inductive capacitive networks, but the fact that the crystal is, in itself a capacitance greatly complicates matters because it produces additional electrical resonance effects. As one peak is removed another becomes apparent and it would appear that some form of isolation, probably a valve, would be needed before anything really worthwhile could be achieved.

W.K. (Auburn, NSW) describes a device for measuring the speed of bullets as they leave the muzzle of a rifle and wants to know where he could get such a design in Australia.

A.: Sorry, W.K., we get the general idea but working out the details would be a major undertaking for a design laboratory and quite out of our line. It may be possible that some of the radio or electrical firms who specialise in industrial electronics may be able to help you but we imagine that the cost would be prohibitive.

D.W. Mc. (Mosman, NSW) wants to know if we have a circuit similar to the 1950 Radiogram but using all miniature valves.

A.: Sorry D.W. Mc., but we are afraid we have nothing along these lines. About the best we can suggest is the 1951 Advance which, although originally designed for a large chassis, used all miniature valves and could, no doubt, be modified to fit on a smaller one. Although only a single-ended output, it has the advantage of a variable selectivity circuit to provide a wider range reception of local stations. One of the major problems of designing miniature high quality gear is that such things as power and speaker transformers cannot easily be reduced and more or less limit the possible reduction.

I.P. (Dalby, Qld.) wants to know if we can obtain the necessary parts for the Multimeter currently described and advise him of the price.

A.: Sorry I.P. (and others) but as indicated in the panel on this page we cannot undertake this kind of commission on behalf of readers. Various advertisers in Radio and Hobbies will be able to advise you of the price for such a kit and will usually forward it by whatever form of transport you specify.

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ALL queries concerning "R & H," designs, to which a POSTAL REPLY is required, must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three "R & H" constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis will now be 3/6. These are available for nearly all our designs.

Address your letters to The Technical Editor, "RADIO and HOBBIES," Box 2728C, GPO, Sydney.

Note that "RADIO & HOBBIES" does not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

Readers say:

IT REALLY WORKS!

I am one of those Amplifier fans who built up the Williamson Amplifier, the Radiotron version, thinking that it was going to be something out of the box. I got a double-headed Connoisseur pickup, two speakers, a Goodman's twin Cone and a G12 PM with a cross-over network. So you can see that I was doing it well.

Now I know that there are plenty like myself who were disappointed with the results. But I did not give up hope. I knew that there must be a way out. So I went through all my back numbers of Radio and Hobbies and in the December, 1949, issue my prayer was answered. On page 64 there was, Suggestions for Amplifiers, by yourself.

I pulled the Williamson's down and rebuilt it with your Pre-Amp in front, putting the power supply on a separate chassis on the end of a 6ft lead, and when I switched the power on, Oh, boy, what a changed Amplifier. More than enough power to spare. With not even the smallest trace of noise, or hum, and the quality both on 78 and microgroove was excellent.

The next thing to tackle was surface noise. So in the same December, 1949, issue I came across A Variable Top-Cut Filter, By W. N. Williams. So I set to work, and built it as described, winding the chokes as well, and believe me, this filter is a wonderful addition to the Pre-Amp, and the Williamson, with no more record scratch worries.

And now I can tell you that I have a Williamson Amplifier that is something out of the box.

Before I close, I want to thank you for the pleasure I get from Radio & Hobbies. H.N.A. (Toorak, Vic.).

WANTS B/C DX PAGE

I have obtained much enjoyment from reading your magazine and consider it the best in Australa. However, I feel there has been something missing ever since the B/C band DX page was discontinued, I therefore ask if you have ever considered returning that page to your magazine.

The Shortwave Handbook, of 1950, was well worth its money but is the time not here when a new edition should be printed of this popular book? (We're looking into this.—Ed.).

Recently I completed a crystal set, using a special honeycomb coil removed from an old factory-made set, and I now have it in operation producing very pleasing results. I have been receiving both 5CK Crystal Brook (about 300 miles from Adelaide) and 3AK Melbourne (about 480 miles from Adelaide). Both stations are received at entertainment level regularly. Not bad for a 14-year-old constructor, do you think? (J. H. Blackwood, SA).

V.H.S. (Brisbane, Qld.) forwards 12 months' subscription and makes a few appreciative remarks about our articles on record reproduction in general.

A.: Your subscription has been forwarded to the appropriate department and no doubt you have received an official receipt by the time you read this. Thanks for your comments on the amplifiers, pick-ups, &c., V.H.S., and we hope that you have by now managed to get things working to your satisfaction. We do try to give readers the most accurate picture possible of the various components available but, as you will appreciate, there are difficulties in this regard. Nevertheless, the recent series of articles showing the performance of a number of pick-ups should assist many to choose one best suited to their needs.

V.M. (Nowra, NSW) wants to know if we have any details of tape recorder amplifiers and also mechanical details of the deck, &c. He also makes some enquiries about disc recording amplifiers.

A.: Sorry, V.M., but we have done no work along the lines of tape recording and consequently have no information of the type you require. The Junior Recorder is still in service and giving excellent results. The circuit and all other drawings which were published in the original article are available through our postal service.

L.J.K. (Bairnsdale, Vic.) has built the "Monty" receiver using a 6A7 in place of the 6J8 and is troubled with motor boating effects.

A.: We think it most likely that the 6A7 is the cause of your trouble, L.J.K., the 6J8 being a somewhat different type of valve, employing separate triode and pentode sections. Although there is some coupling between the two it is not sufficient to cause trouble in this circuit. The 6A7, on the the other hand, uses a common electron stream for both sections and the coupling is probably great enough to cause feedback. There seems to be no cure we can suggest other than the fitting of the correct valve.

G.H.P. (Moree, NSW) wants to know whether we can supply him with constructional details of a Geiger counter.

A.: Sorry, G.H.P., but we have no details of these devices and can only suggest that you contact an organisation dealing in industrial electronics.

L.E.G. (Darken, WA) writes in appreciation of Radio and Hobbies and details some of the projects he has built from the magazine and the results he has had.

A.: Many thanks for your kind remarks, L.E.G., and we wish you the best of luck with your ham ticket. You may find some interesting information on learning the code in the 1950 Short Wave Handbook (a few copies are still available at this office, price 2/-) and which also contains some useful information on transmitters and receivers. As you say, the 0-1mA position on the multimeter can be made to function for the two highest ohms ranges and it would be possible to use the extra position for another range. However combinations like this are not always quite so convenient as the more conventional ones, although quite all right if you are prepared to accept this slight limitation. A 1 amp shunt should be quite in order, but for anything larger it would be better to consider external shunts. It is difficult to say just how the hash is being introduced into your receiver but it is often necessary to conduct extensive experiments to track the cause, or causes, of such trouble. If you can supply us with some additional information on the performance of the set with the earth wire attached, we may be able to suggest the cause of the reduced signal strength. Some articles on the Clapp oscillator appeared in QST for August 1948, October 1948 and January 1949.

H.N.A. (Toorak, V.), describes his experiences with the Williamson amplifier and the preamplifier and top cut filter. He also expresses his appreciation of Radio and Hobbies.

A.: Glad to hear that the combination was such a success, H.N.A., and that you are deriving so much pleasure from it. Much the same remarks apply to any amplifier, namely, that a preamplifier and, perhaps, a top cut filter, are needed with most modern pickups. Many people fail to appreciate this point and are consequently very disappointed at the results of modern pickup-amplifier combinations. Many thanks for your kind remarks about the magazine.

G.S.S. (Cemberton, WA). We assume from your second letter that your problems are now solved and trust that your project will reach a successful conclusion.

H.A.S. (Ormond, V.). The Playmaster series were intended for the more advanced workers who are used to compiling their parts lists from the circuit and so we regret that we have no such lists available. A chassis blueprint is available, price 3/6. Whether a top cut filter is necessary is more dependent on the program material than the amplifier and you will have to decide this point for yourself. It is certainly desirable when playing ordinary 78 rpm records through a wide-range speaker. The No. 2 Control Head provides a top cut control in addition to the adjustments for the various recording characteristics.

V.L.M. (Royal Park, Vic.), raises a few points about the Popular Science Quiz of the January, 1952, issue.

A.: Thanks for your letter, V.L.M. We are pleased to receive general comments whether they be criticism or not. In the case of the science quiz, space limitations reduce the answers to a generalisation of a subject raised and in some cases, it may appear that some points have been missed. In the main, the points given in your letter and those made in the science quiz in question run along parallel lines.

M.G.C. (Jannali, NSW), is troubled with a scratchy noise in his amplifier and wants to know if we can tell him what it is. He also makes inquiries about circuit, &c., for the Slumber Set.

A.: From the brief information you have been able to supply it would be impossible for us to more than guess at what the trouble might be. We can only suggest that you go over the set carefully for obvious faulty joints, tap each component lightly to see if the noise is aggravated and, if possible, borrow some spare valves for a trial replacement. Failing this it might be better to enlist the aid of a competent serviceman. The circuit and parts list of the Slumber Set is available through our postal service.

V.J.H. (Mildura, Vic.) wants to know where he can get full details of how to make a simple one-valve set.

A.: We have several designs of simple sets on our files although we have no back copies of the magazine giving full constructional details. Whether you feel competent to work from diagrams alone will be for you to decide. These diagrams are available through our postal service (see details this page). We would be in a better position to advise you if we had more details of the type of set you require and whether AC power is available.

D.C. (Auckland, New Zealand) forwards 12 months' subscription and inquires about devices to give three-phase output from a single phase circuit.

A.: Your subscription has been forwarded to the appropriate department, D.C., and doubtless you have received a receipt by now. We have heard of the circuits you mention but have no details of the methods employed. We suggest that some of the transformer manufacturers who advertise in Radio and Hobbies may be able to help you.

L.R.T. (Casino, NSW) asks some questions about helicopters, the main query being as to the direction of rotation of the body if there was no stabilising prop.

A.: As you say, L.R.T., this is a bit "off the track" but we will do our best. The body of the machine would rotate in the opposite direction to that of the main blades and the easiest way to visualise this is to imagine what would happen if these blades were to be suddenly gripped by a giant hand and prevented from turning at all. Much the same effect is created by the resistance of the air except that it is not great enough to stop the blades completely. The pitch of the stablising prop is varied to achieve steering.

FROM THE SERVICEMAN WHO TELLS

(Continued from Page 55)

But there was more to it than that. Normally the movement of the pointer carriage would have been so free that the method of fastening the dial cord would have been more than adequate, but in this case it was sticking at several points on the slide bar and moving only with difficulty elsewhere.

The cause was a very liberal coating of grease which had apparently been applied at the factory, and was intended to prevent just this kind of trouble. However, over the following months this grease had slowly hardened. It was assisted, no doubt, by the heat from the valves, since the dial was on the top when the set was in the cabinet, and had now reached the stage where it was effectively gumming the works rather than lubricating them.

TROUBLE EXPLAINED

This was also the explanation of the early morning jamming. The stationary pointer and the lower temperature allowed the grease to set hard and anchor the mechanism so firmly that the cord would slip on the drive-shaft rather than move the pointer. While it could eventually be freed by continuous turning of the shaft, this placed an abnormal strain on the coupling between the cord and the pointer carriage, eventually breaking the lacquer seal and giving rise to the drifting calibrations.

A few minutes with a cloth and some methylated spirit removed the offending "goo," after which the slider moved quite freely, while a spot of nail polish (kindly supplied by the lady of the house) sealed the cord to the pointer carriage once more.

I decided that another application of grease would only mean a repetition of the fault in a few months' time and that it would be better to let the mechanism run "dry." After all, it was hardly running with the precision and speed of a car engine and the wear involved was not likely to be serious over the normal life of the set, so that the advantages of grease are doubtful and the disadvantages very real.

I have no doubt that most manufacturers will continue to use grease in this application, in spite of my plea, but I do think they might ask themselves whether it is not just a habit that has grown up over the years without any proper investigation as to its real worth or otherwise.

FURTHER FAULT

The second fault showed up when a set was being given a routine alignment after the major fault had been repaired. The upper slug of an IF transformer had been peaked and the set turned on its end to permit the lower one to be adjusted. As I applied the lighting tool to the slug and commenced to turn it, the output suddenly dropped quite markedly.

It was far too great a change to be due to the adjustment of the slug (which had only been rotated a fraction of a turn), and I suspected that some part of the coil was not as firm as it might be. However, a preliminary check showed nothing, and I was able to proceed with the adjustment on the slug without any further irregularities in output.

When this had been peaked I checked again on the upper slug (leaving the set still on its side), and was surprised to find that it now needed moving several turns out to bring it on to the peak again. It seemed obvious that pressure applied to the bottom slug had somehow effected the tuning of the upper one, but for the moment I was at a complete loss to explain why.

I restored the set to a horizontal position and tapped the sides and top of the transformer can with the blunt end of the alignment tool. As I hit the top of the can the output suddenly dropped again, and by approximately the same amount as before. Again the level was restored by adjusting the upper slug, only this time I had to screw it in.

LIGHT DAWNS

With the set up on end again I tackled the lower slug, this time keeping it under close observation. As I applied pressure, the whole of the bottom moulding moved slowly into the can about 3/16ths of an inch. As I say, it was a slow movement, too slow to be easily felt, and requiring quite a substantial pressure to cause it. At the same time it was quite obvious that something was loose enough to respond to severe vibration, and called for closer investigation.

I removed the can and, while holding the upper slug, tugged on the lower one. There was quite a definite movement between the two which was traced to the point where the coil-former was supposed to be attached to the upper moulding, the latter being normally mounted against the top of the can. Thus the windings, the core, and the lower moulding were suspended at this point and, apparently, the joint had either been poorly made or shrinkage of the coil-former had broken it.

Anyway, whatever the cause, it was now possible to move the whole assembly, and in particular the upper winding, with respect to the upper slug, with consequent severe detuning of this winding.

OKAY AGAIN

A liberal application of coil dope to the moulding and coil-former made a joint which looked like staying put, and after leaving overnight to set, the unit was reassembled, mounted in the chassis, and aligned. This time the alignment proceeded smoothly without any abnormal variations in level, and the final sensitivity was probably much better than it had been for a long time.

I have not heard of any of my colleagues having similar troubles, but it is perhaps significant that modern coil designs favor the moulding of the former and ends in one piece so that troubles of this kind are unlikely. Nevertheless, there are plenty of the older variety about, and it is still a possible fault which might be easily overlooked.

Wanted to Buy Sell or Exchange

FOR SALE: AR8 receiver, AT5 transmitter, AT5 aerial coupling unit, type S power supply for 230V AC operation, junction box and connecting cables, instruction manual, AWA class C wavemeter. Best offer over £50. **M. M. Ross, 112 Campbell's Cres., Ballarat.**

FOR SALE: Professionally finished recording panel, 5ft high x 19in—cutting head, traversing gear, turntables (less motor), cutting monitor, 4MIC Chann volume comp. patch panel, metering AII stages, black crackle finish, gold lettering, power supply, 20 valves all in working order. Sell £60/-/-. or offer. **C. Best, 22 Crimea St., Parramatta. UW6660.**

FOR SALE: 27 boxes radio parts, £3/10/-. **L. Smith, Segenhoe, Scone.**

FOR SALE: Axiom 80 speaker, little use, £25 or offer. **DeLaRue, 20 Russell St., Northcote. JW1841.**

FOR SALE: New Acos GP20 pick-up. Exch. Rola 12" speaker or sell. New Goodman 150 speaker, sell cheap. What offers? **Dabelstein, Musgrave Hill, Southport, Q'ld.**

FOR SALE: Comm. receiver type CRV 46151, ex aircraft, 195kc to 10meg, full cover 4 bands, dual control man, or remote, cable plugs and remote control for above input volts 24V DC and 240V AC. Price £29/10/-. **FW4819 or 99 Adelaide Pde., Woollahra.**

SELL: 1FTs unused, 10/- pair. 6-volt vibrator trans., 150 volt, 20/-. Valves 1K7, 1L5, KK2, KF4, C1, Barreter, 10/- each. **R. Pearce, 136 Lestrange St., S.A.**

SELL: Transceiver No. 11, receivers AR14 and AR8, wave meter, class C, No. 1, all complete with valves but no power packs. Best offer. **2 Griffith Av., Roseville. JY1066.**

SELL: Ferguson OP25 FFR trans. 10,000 pp to 12/3 ohms. Power supply 500 volts, 200 mA. Lot £12/10/-. **WM1647.**

SELL: G'mans 150 loudspeaker as new, £22. **16 Taylor St., Brighton, Vic.**

SELL: Vibra 5 complete less cabinet, extra parts, £22 or offer. **Perry, Wollar 6W, NSW.**

SELL: 60-watt transmitter, excellent performance. Full particulars. Ring LX3993.

SELL: University supertester and XOA oscillator as new never used, plus extras, value £80. Lot £50. **FX1492.**

SELL: Recording head and 16-inch traversing gear, new, £9.. Multi meter, 48 ranges, cost £45, sell £25, new. **Laxton, Lot 11, Sylvania R., Miranda, NSW.**

WANTED: FS6 transceiver, complete and in good condition. Price and particulars to **Geo. P. Hocking, "Glenalla," Berrybank, Vic.**

WANTED: FS6 in perfect order. Please quote price when replying. **W. Mayne, "Tecoma," Hastings, Vic.**

WANTED: Power transformer and choke rewinding work. Quick service. **T. Stephenson, 2 Coota Rd., Temora.**

WANTED: Valve tester. **Tony Loricco, 50 Murray St., Colac, Victoria.**

WANTED: Cinema organ recordings, Foort, Dixon, McLean, others. **Reply Box 262, Haymarket, Sydney.**

SELL

Standard V.C.T. and V.C.T. Vib. good order, also large quantity used valves excellent condition, practically all types, **10/- each.**

E. M. PARKER, BOX 88, JANDOWAE, Q.

A SIMPLE 4-BAND TRANSMITTER

(Continued from Page 75)

Mc. Make sure that the send/receive switch is in the receive position and connect the power plug with the mains. After allowing the valves to warm up switch the "transmit phone" position. Without the modulator plugged in there will be no high tension applied to the PA.

With the meter switched to read the grid current of the PA tune the plate circuit of oscillator to resonance. With a good crystal it will be possible to tune for considerably more than 5 mA grid current. However, with this type of oscillator the plate circuit should always be tuned slightly to the high frequency side of resonance in the interests of stable operation.

You will note that the oscillator comes into operation gradually when tuned from the high frequency side of resonance, while it comes into operation very sharply if tuned from the low frequency side. If the circuit is tuned to the peak a slight detuning will cause the circuit to go out of oscillation.

Make a similar check with a 7 Mc crystal as a matter of routine. Having satisfied yourself that all is in order, try operating the oscillator as a tritet with both 3.5 and 7 Mc crystals. If the grid current is below the figures quoted earlier it may be necessary to vary slightly the number of turns on L1 or L2 as the case may be.

TRANSMITTER COIL DATA

L1 17T 25 B & S, closewound.
L2 9½T 25 B & S, closewound.
L3 40T 25 B & S, closewound. Tapped at 28T.
L4 13½T 20 B & S, closewound.
L5 5½T 20 B & S, spaced 7/16in.
Coils L1 to L5 wound on ¾in diam. formers 2in long. L1 & L2 are wound on a single former 1in apart, similarly L4 & L5 ⅝in apart.
L6 3.5 Mc—34T 20 B & S, closewound on 1½in diam. former.
7.0 Mc—24T 14 B & S, spaced 2in on 1½in diam. former.
14.0 Mc—15T 14 B & S, spaced 1½in on 1½in diam. former.
28.0 Mc—9T 9 B & S, spaced 1¼in on 1½in diam. self supporting.
L7 Adjust to provide correct loading.

Before high tension voltage is applied to the PA it is necessary to neutralise it. Plug in a final tank coil to cover the frequency at which the grid is being excited. Then, with the meter reading grid current and the send/receive switch switched to the phone position as before, tune the final tuning condenser through resonance. The resonance point will be indicated by a sharp dip in the grid current.

The valve will be neutralised when the neutralising capacitor is adjusted, so that the dip is no longer noticeable. You can then switch back to position 2 of the send receive switch tnd tune the final to resonance as indicated by a sharp dip in the high tension current of the final amplifier.

Provided all the final tank coils are accurately centre tapped the one setting of the neutralising capacitor will serve for all bands.

The final step is to load the transmitter into an aerial and check it on the air. The amount of loading is varied by adjusting the number of turns of L7, which is wound around the outside of L6. For full power the loading should be adjusted so that the plate current of the PA at resonance is 50 mA.

In he case of the 28 Mc coil which is self supporting the loading may be adjusted by varying the position of the 2 turn link in relation to L6.

As a final check before operating the transmitter for extended periods, have a nearby amateur check the signal for chirp, clicks, back wave and other undesirable characteristics. There aren't likely to be any if you have previously checked the signal in your own receiver, but it is just as well to be sure.

Since there is no special click filter the keying characteristic may tend to be a little sharp, but by no means objectionable. We will have more to say about this in the later article in which we will describe the companion modulator.

JUNIOR RADIOGRAM

(Continued from Page 63)

tune in a station toward the high-frequency end of the range. Adjust the oscillator trimmer until the station is tuned in at its correct position and "peak" the aerial trimmer.

Tune to a station at the low-frequency end, say, 2FC, and adjust slug or variable padder) until it is the oscillator circuit (that is, coil tuned at its correct spot. "Peak" the aerial coil slug. Tune back to the high-frequency end and repeat the trimmer procedure.

Now select any station, preferably a weak one, so that changes are more readily noticed, and "peak" the slugs in each end of both IF transformers. Go over these twice.

That's all there is to the alignment. The golden rule is "coil slugs at the low-frequency end, trimmers at the high-frequency end."

TV SERVICEMAN

(Continued from Page 7)

line up to the attic. Once this obstacle was removed, reception was perfect.

Another baffled family had to choose between video and heat, until a technician solved the mystery. When the new TV set was tuned in, the oil burner quietly ended operations. RCA's sleuth discovered that a receiver should never be located under a thermostat—especially in winter weather.

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